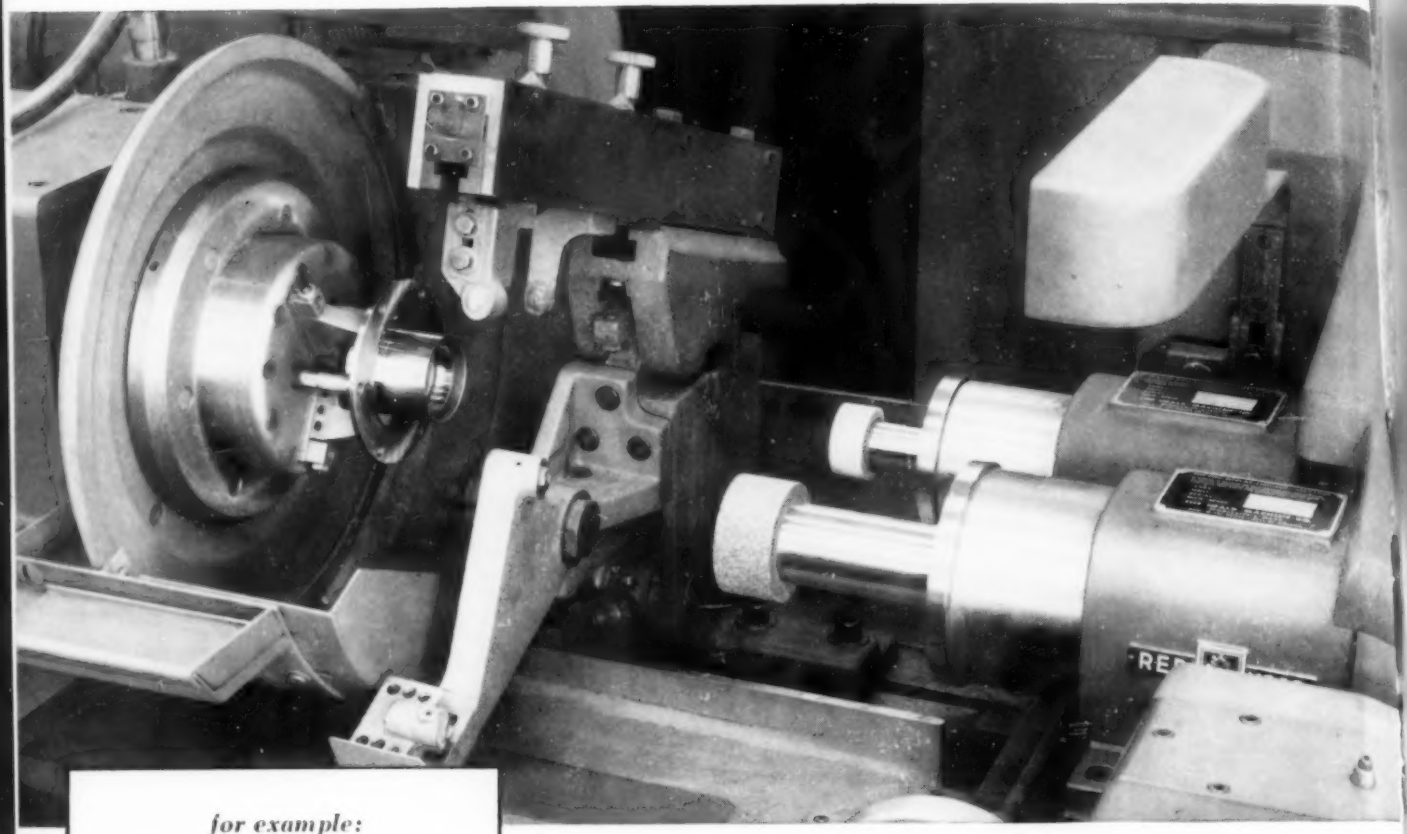
THE TOOL ENGINEER

JULY 1955

JOB SHOP PRODUCTION

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

how to convert handling-time into grinding-time with a TWO-SPINDLE HEALD INTERNAL



for example:

This Model 271 Size-Matic grinds

SIX DIFFERENT SURFACES

at a single chucking

Finish grind I.D.—plunge grind bottom face—plunge grind hub face—finish grind O.D. — plunge grind flange face — finish grind flange O.D. *All* of these operations are done, at a single chucking on the Model 271 two-spindle internal shown above. And by reversing the part in the chuck, the same operations (except flange O.D.) are done on the opposite end — a total of 11 different surfaces on one part in one machine!

Fourteen identical machines are used by one manufacturer to grind 34 different gears and gear hubs, with interchangeable workholding fixtures. That's Heald *versatility* in action.

THERE'S no profit in handling-time. Loading and unloading—transferring parts from one machine to another—serve only to cut down the overall efficiency of any precision production operation.

Whenever you can combine bore and face grinding — or bore, face and O.D. grinding—on a two-spindle Heald internal, you convert handling-time into actual *grinding-time*. That means faster, more efficient production by performing two or more operations on a single machine, at a single loading. Moreover, concentricity and squareness between Heald ground surfaces are automatically held to extremely close tolerances.

The versatility of Heald two-spindle internals permits a wide variety of parts to be precision ground on I.D.s, O.D.s and faces in a high-speed, fully automatic cycle. Your Heald representative will be glad to show you how a double-spindle machine can cut costs on your multiple-surface grinding jobs.

it PAYS to come to Heald

Booth 902

AT THE MACHINE TOOL SHOW

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Cover: Job lot production can embody many of the recent advances in tool engineering that have been linked with mass production industries. Carbide tooling, particularly, can step up the small shop's efficiency, according to the article beginning on Page 77.

The Tool Engineer

Volume XXXV, No. 1 July 1955

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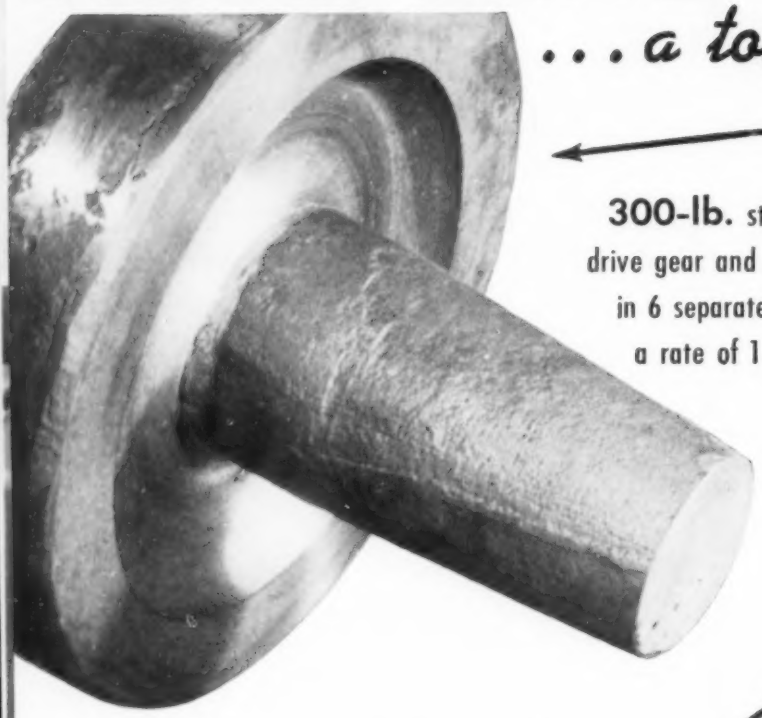
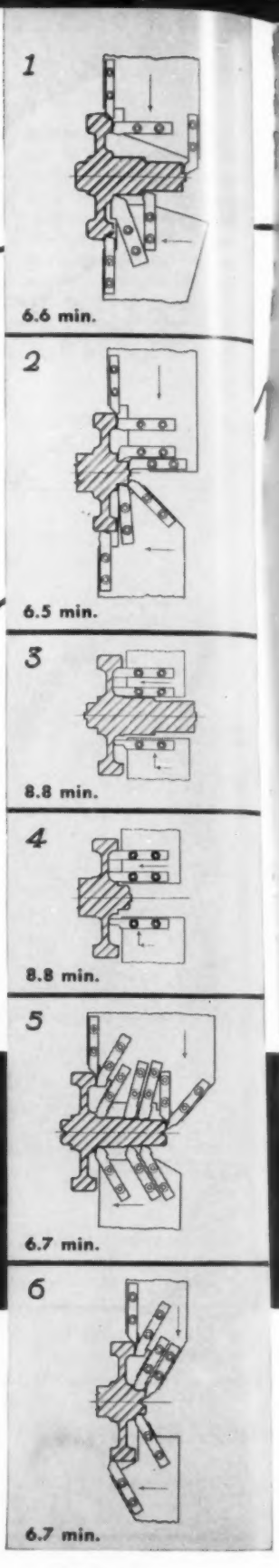
THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and the *Industrial Arts Index*

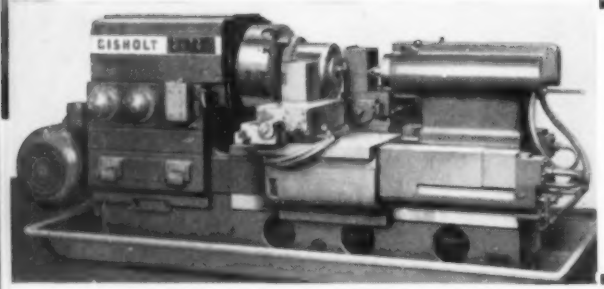
here's A JOB ... a tough one!



300-lb. steel forging for final drive gear and shaft—machined in 6 separate operations—at a rate of 1 finished piece per hour.



here's THE MACHINE ... that licks it!



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Here's how Western Gear Works of Belmont, California, solved their problem:

With two longitudinal carriages and two transverse tool slides, the standard No. 24 machine has the flexibility to combine rapid traverse and feed in several directions. Hydraulic controls make it very simple to change setups.

Now, note how tooling costs were cut by using mounting plates instead of special slotted tool blocks. Large tool bit shanks are slotted, and thus are easily set before final bolting down. The complete riser blocks are quickly interchanged for various operations. And here, again, Gisholt's traditional power and rigidity show up on cuts that pull up to 80 h.p.

For low costs on tough jobs, think first of the Gisholt No. 24 Hydraulic Automatic Lathe. Write for literature.

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The Tool Engineer

Conserving Engineering Time

With more and more engineering data to aid tool engineers, calculators will become increasingly useful. They eliminate the time and drudgery of manual computations as well as the human factor which contributes to possible errors in arithmetic.

Digital calculators, adding machines, have long proved their worth in practically all departments of an organization. They, however, are becoming too limited and cumbersome in many routine calculations. For this reason, analog computers will move from research labs into engineering offices and may soon become general all-purpose tools for the engineer. They will be regarded with the same confidence and affection that the adding machine now enjoys.

Analog computers have been surrounded with mysticism and are generally regarded with awe. This is why their use has not been widespread. Also, the analogies between electrical circuits and physical factors are not usually understood. Yet special-purpose analog computers are involved in the control circuits of many automatic machines.

Recently, a machinability computer was developed by Carboloy Division of General Electric to interpret known metal-cutting data to the problem of a specific job. The relationships among nineteen known variables are built into this analog calculator so that when desired values of any combination are fed into it, it will indicate the values required of other factors. Included are feed, speed, depth of cut, type of tool, geometry of tool, conditions of workpiece, cutting fluid, etc. The calculator, however, presupposes that cutting conditions are within the normal range and that tool chipping or other undesirable conditions will not occur.

Calculators such as this can save hours of time and assure that the most recent data may be applied to production methods. The extravagance of guesswork is being slowly eliminated. Where judgment of the engineer is required in interpreting and applying data, computers can be of tremendous help, freeing the engineer for more creative thought.

John W Greve

EDITOR

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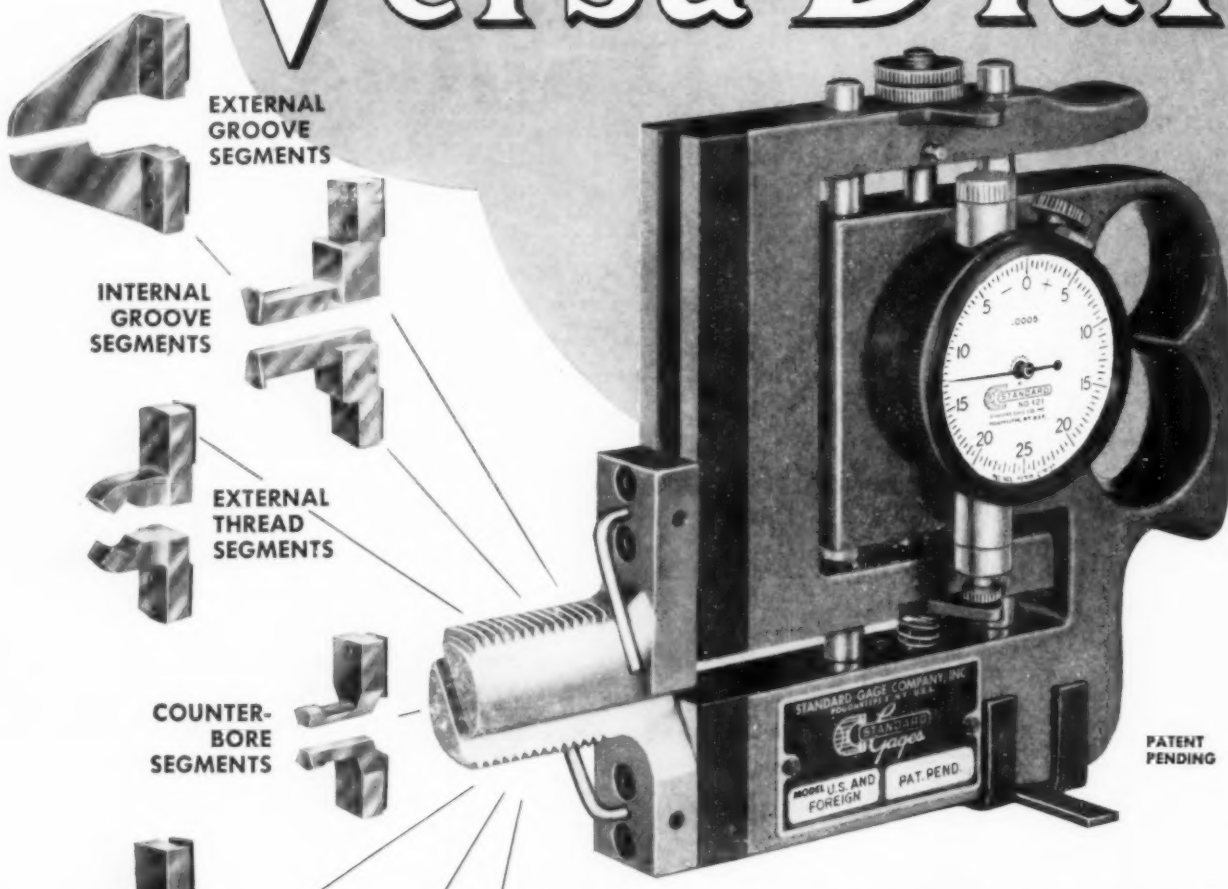

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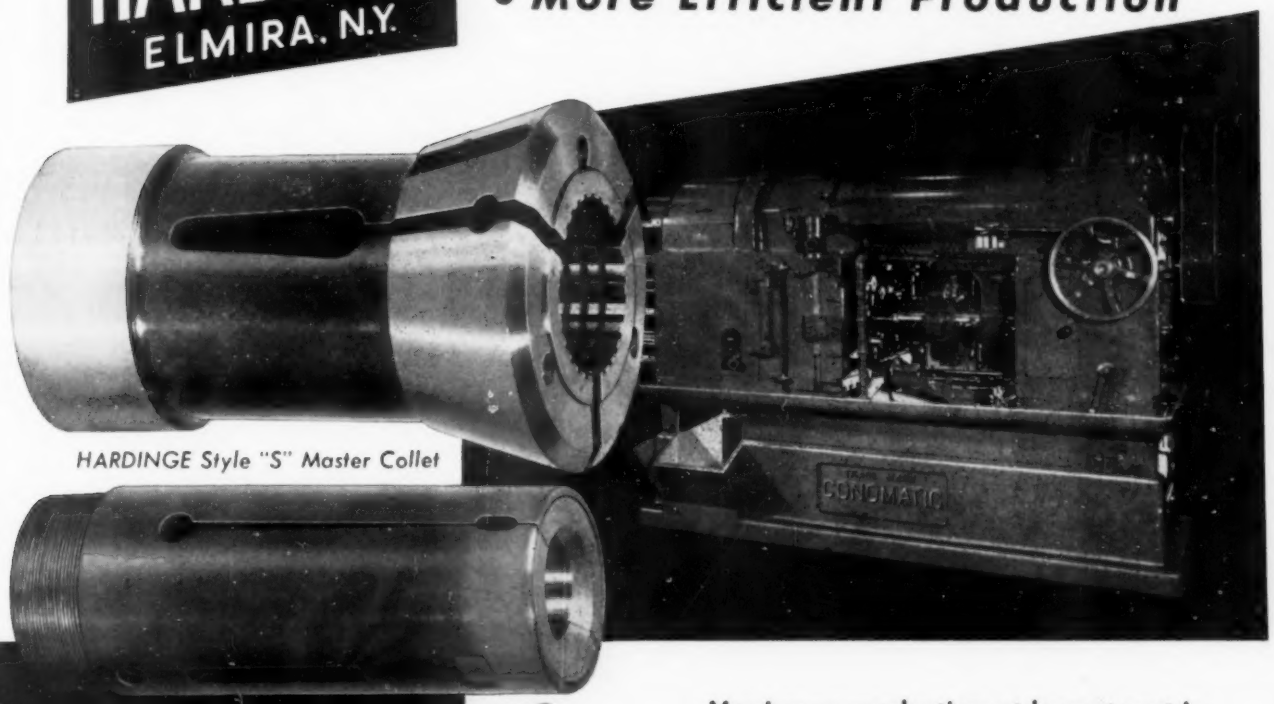

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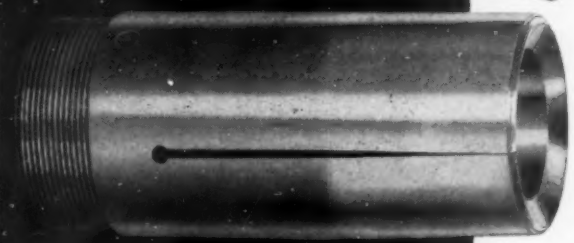
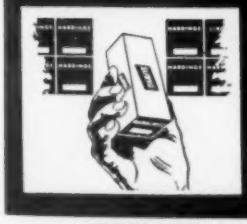


HARDINGE Regular Feed Finger



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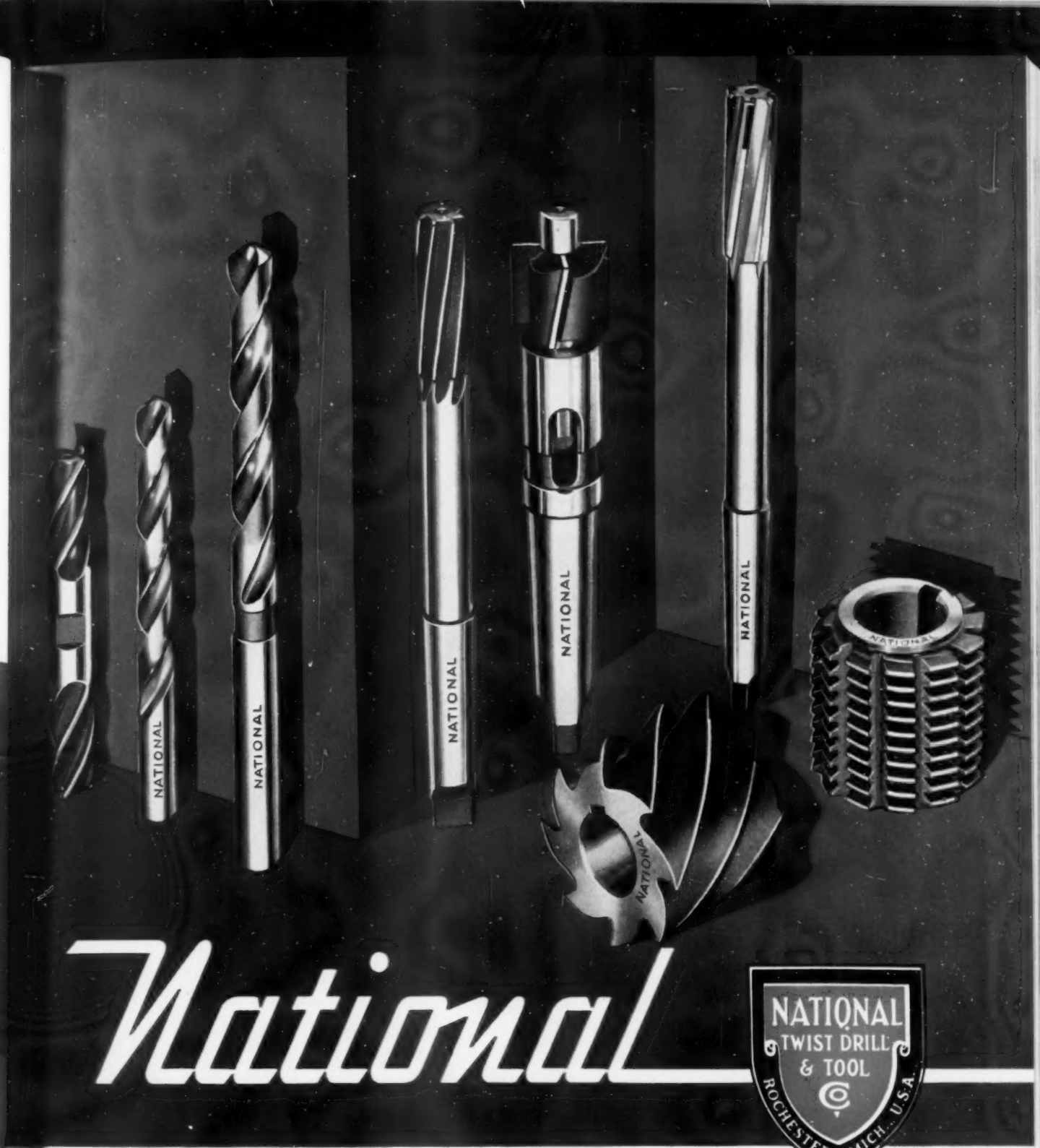

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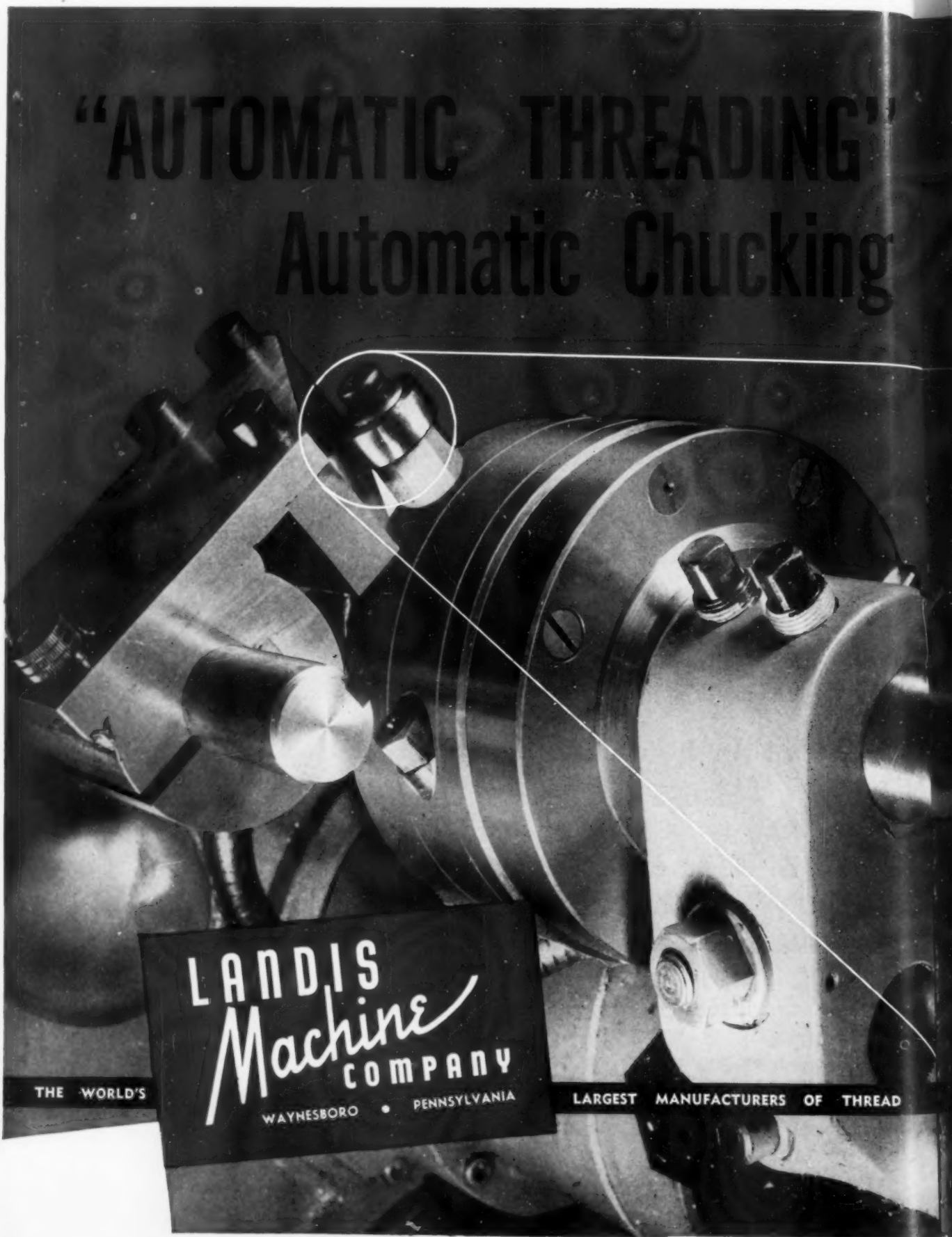
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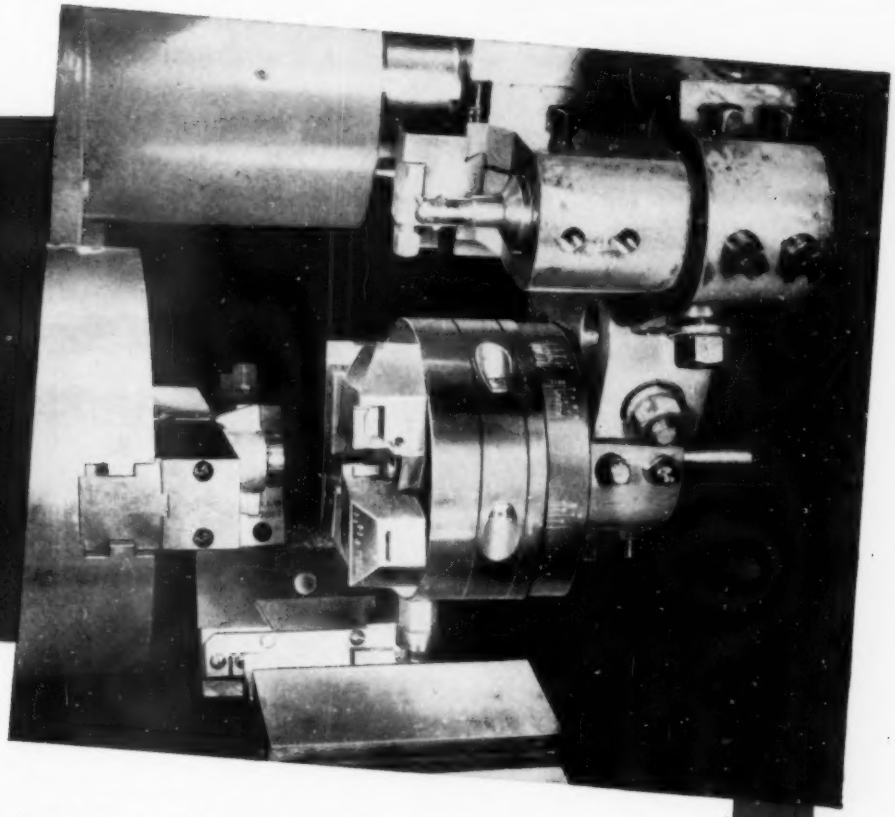


The adaptability of Landis Heads is once again proven by this application of a LANDMATIC Head on a #1AC Warner & Swasey Automatic Chucking Machine. Normally, the LANDMATIC is applied to turret lathes and while self-opening, it is closed manually. To adapt this stationary head for automatic operation on the Automatic Chucking Machine, only two steps were required: (1)—the addition of a closing roller in place of the handle and (2)—the use of special closing pins which provide overtravel, eliminating the need of a complicated, accurately-set closing cam.

This adaptability has paid off for the S&C Electric Company, Chicago, Illinois, manufacturers of high voltage protective equipment.

Besides a completely automatic threading operation, this head, through the use of long life tangential chasers, offers lower tool cost and less down time. For example—when threading the workpiece shown, a contact ferrule of 85-5-5-5 cast red brass requiring a 1⅜"—16 Pitch UN thread ⅜" long into a 1/16" relief, complete runs of over 3000 pieces are made without grinding the chasers.

Another outstanding feature of LANDMATIC Heat-Treated Heads is their wide range coverage and oversize capacity. The 2" Head, illustrated here, will normally thread all diameters ranging from ⅜" to 2". Using oversize chaser holders, its range can be increased to thread up to 3¾" in diameter.

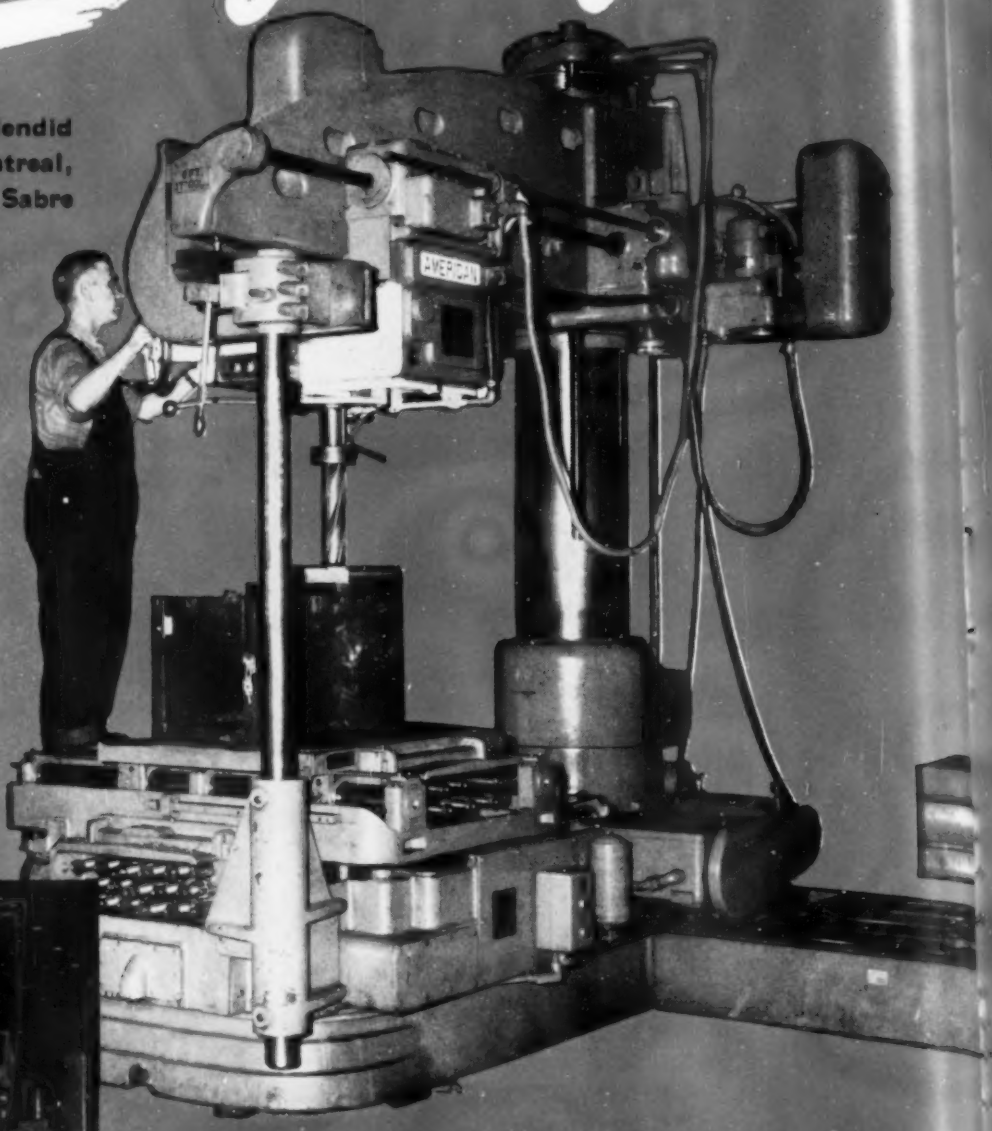
For more complete information on LANDIS Heat-Treated Heads for rotary or stationary applications, straight or tapered threading, ask for Bulletin F-90. Please send specifications when writing.

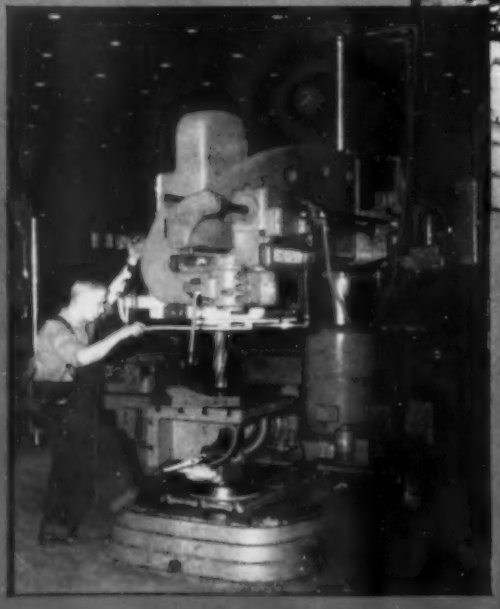
GENERATING EQUIPMENT

On TOP of his job!

This operator is doing a splendid job at Canadair Limited, Montreal, on the production of F-86E Sabre Jets for the RCAF and, as the illustration shows, he is right on top of his job, too.

He is proud of his fine new 6' 17" column "AMERICAN" Hole Wizard Radial. "It's powerful; it's sturdy; it's easy to operate, and I'm not worn out at the end of the day". What more could any operator ask? As a consequence he turns out a lot of fine work which makes his machine a paying investment for the company.





This *"American"* Hole Wizard Radial has a right angle base, on one wing of which is mounted a Bullard Man-Au-Trol Spacer—as shown by the illustration.

"AMERICAN" Hole Wizard Radials are playing a prominent part in the production of critical defense items for both the U. S. A. and Canada.

For a complete revelation of their virtues send for descriptive bulletin No. 327.

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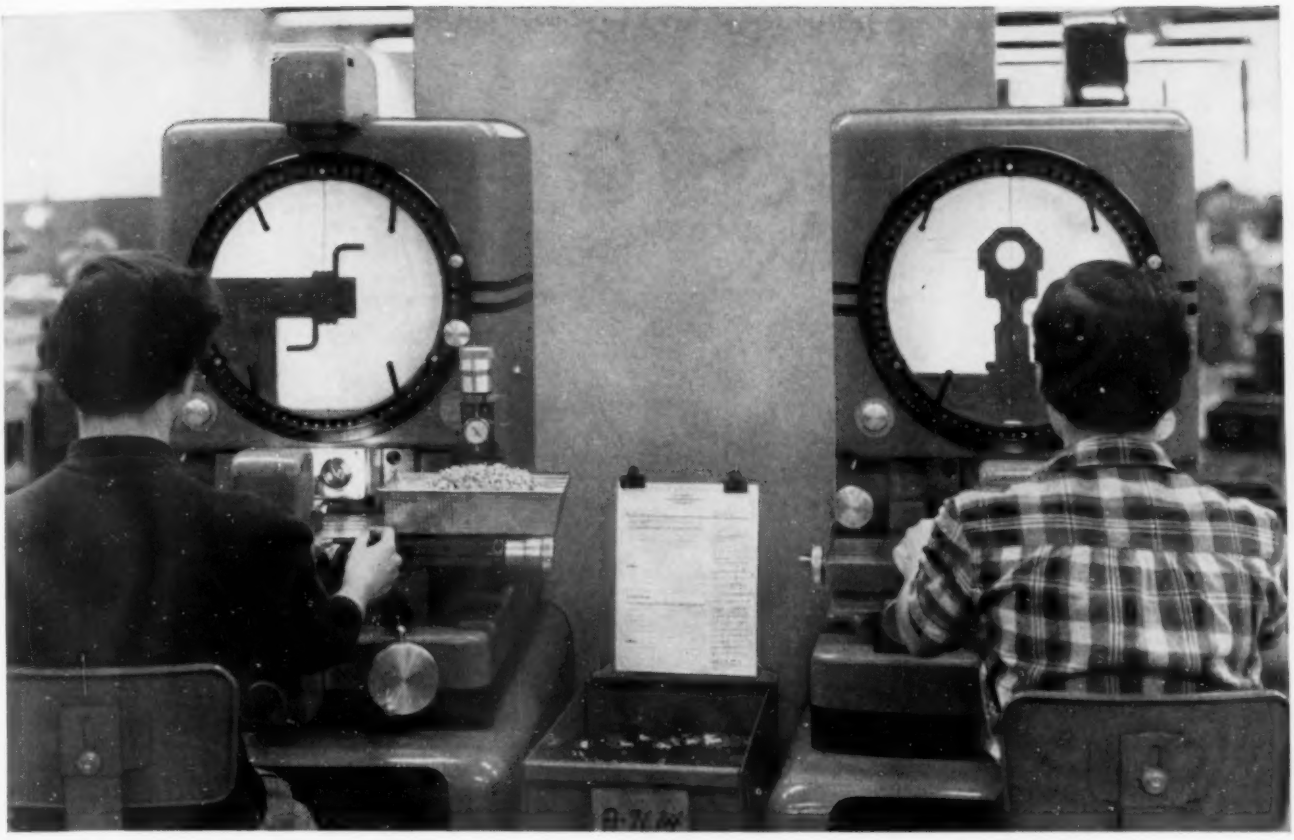
LATHES AND RADIAL DRILLS



Girls at the Allen-Bradley Company, leading makers of electrical equipment, use Kodak Contour Projectors to inspect incoming precision parts quickly and accurately.

To speed parts from receiving dock to production . . . Allen-Bradley uses Kodak Contour Projectors

Receiving inspection can be a bottleneck, slowing the production operation when, on an average day, many separate shipments of component parts crowd the receiving room.

To avoid such a bottleneck and keep production lines moving, the Allen-Bradley Company combines statistical sampling methods with modern gaging equipment. Kodak Contour Projectors are used to check more than 400 different items, most having multiple dimensions and sample sizes of 35 or more pieces. Tolerances are held as close as .001".

Because optical gaging affords a check of several dimensions simultaneously, Allen-Bradley has cut inspection time dramatically: a typical part, requiring minutes to gage mechanically, now is checked in 12 seconds optically.

The result: No unnecessary delays—parts are quickly cleared for production. And quality control has improved.

You'll find that Kodak Contour Projectors are profitable wherever you need fast, accurate, complete inspection or measurement of almost any sort of part—simple or complex, large or small. And there are models to fit every need from the large Model 30 to the bench Model 8. To learn more about optical gaging and how it can help solve your problems, send for our illustrated booklet, "Kodak Contour Projectors." Use the coupon below.

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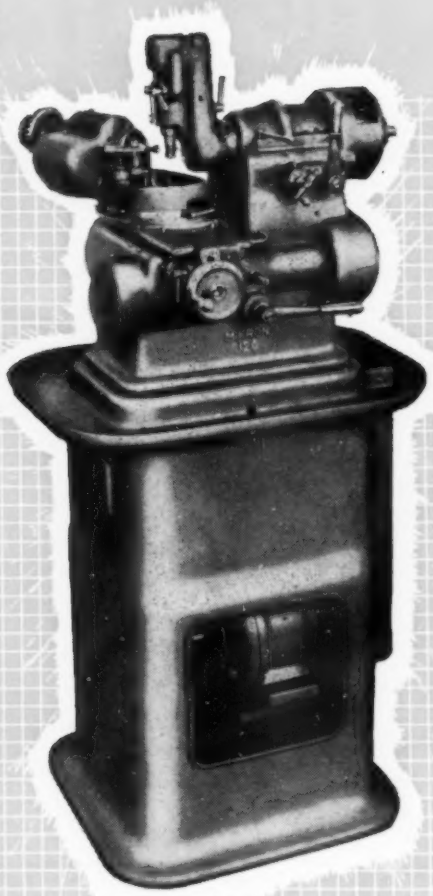

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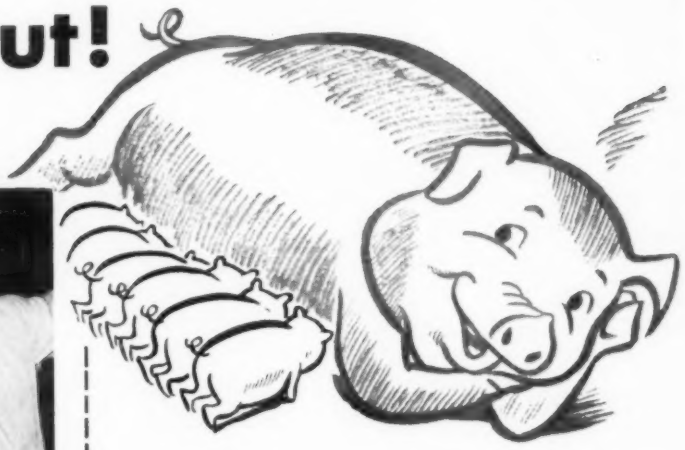

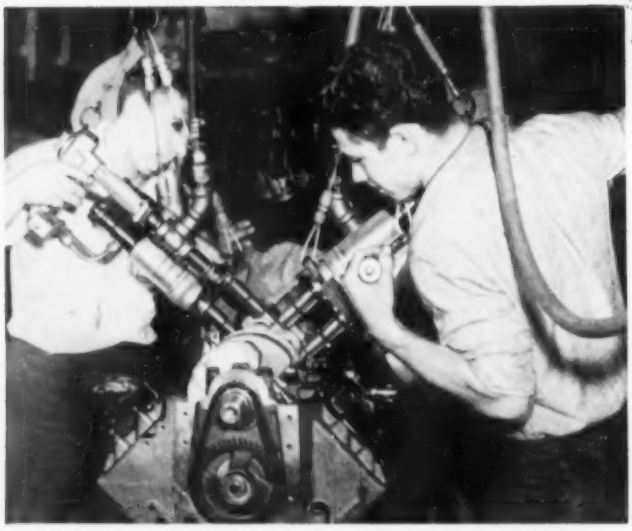

2-Spindle Multiples tighten connecting rod bolts on the assembly line.

A 6-spindle Multiple Nut Setter assembles automobile crankshaft to flywheel.

The new Keller Multiple Nut Setters improve quality control and reduce production costs. Manufacturers have been quick to make use of their advantages:

1. Built-in torque regulation in each individual spindle, giving control of torque on each bolt. Torque is adjustable from 4 to 190 ft/lb.
2. Torque held within close tolerances—comparable to that obtainable with accurate hand tools.
3. Increased production and lower production costs.
4. Easily adaptable to changing needs . . . a change in bolt spacing merely requires a new mounting plate for the spindles . . . when a job is completed the spindles are completely salvageable for use in another Multiple.

Do you have applications where bolts or nuts can be run and tightened two or more at a time? If so, it will pay you to investigate this remarkable tool. Write for Bulletin 16-101.

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DIVISION OF **GARDNER-DENVER**

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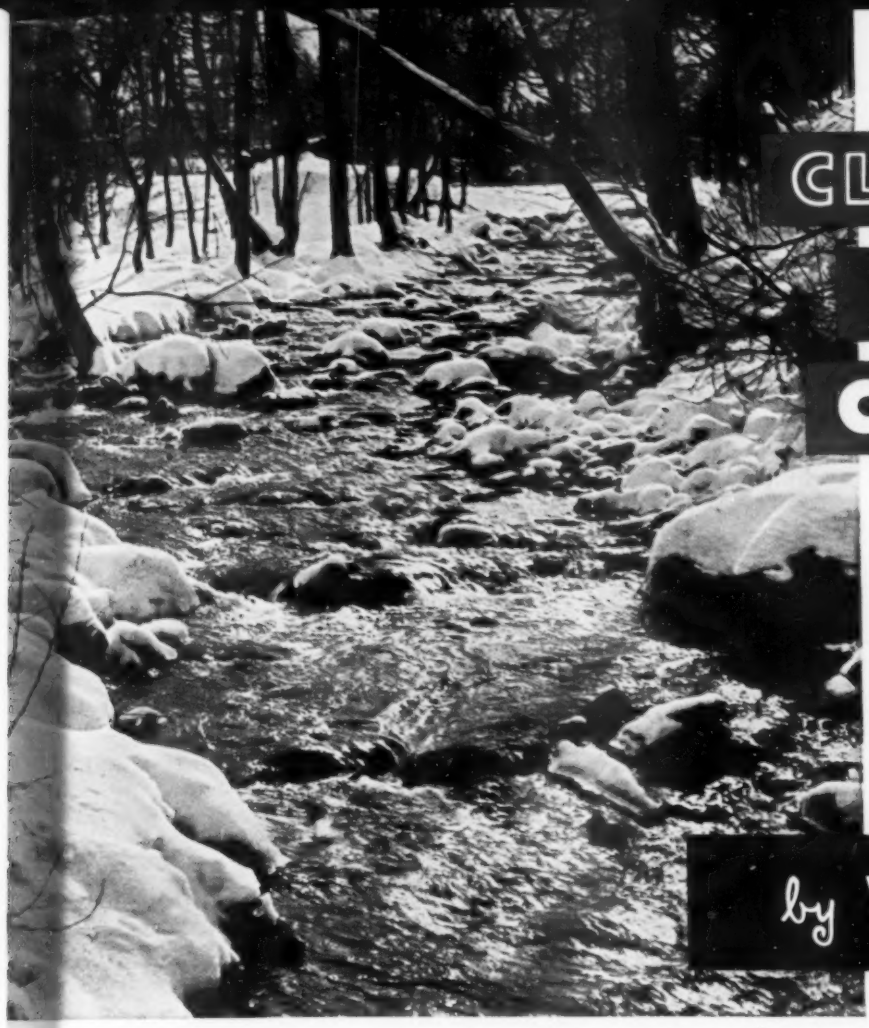

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in either *liquid* or *crystalline* form

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COOL. Uniform, complete wetting of metal provides maximum cooling. No steam or smoke; quicker, cooler, safer handling of work-pieces by your operator . . . *Results:* increased accuracy and higher production.

CLEAN. Grinding wheels stay clean and free-cutting. Fewer dressings reduce wheel cost. Clean machines remain free of caked residue. *Triple C on floors and clothing dries without residue or odor.* Filters do not clog.

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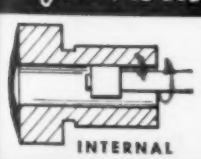
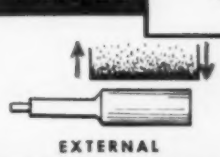
THE MOTCH & MERRYWEATHER MACHINERY CO
CUTTING TOOL MANUFACTURING DIVISION
CLEVELAND 17, OHIO

*Trade Mark

for results you can see . . . TRIPLE **CCC** FOR ALL WET GRINDING


INTERNAL

FLAT RECIPROCATING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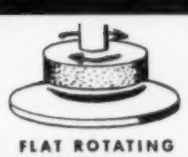

FLAT ROTATING

CENTERLESS

TRIPLE C BRINGS A CLEAN DEAL TO YOUR MACHINES, OPERATORS, AND SHO

you are invited to see our

"LIVING CATALOG"

of the newest LAPOINTE

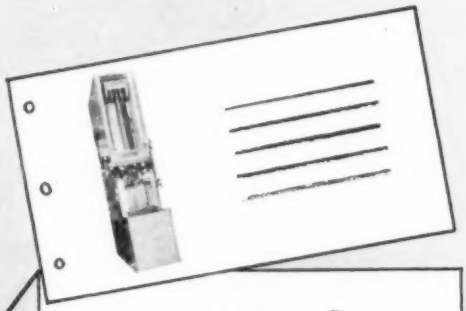
BROACHING MACHINES

in action ... at

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 9-17, 1955
INTERNATIONAL AMPHITHEATRE

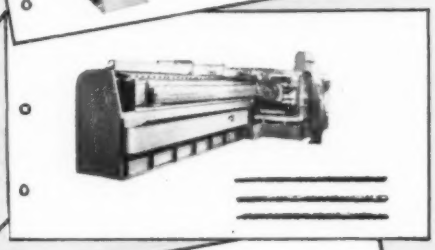
booth 707

This is your opportunity **to be brought up to date** on the amazing progress that has been made in the past few years in BROACHING, **the modern method of machining metal!**



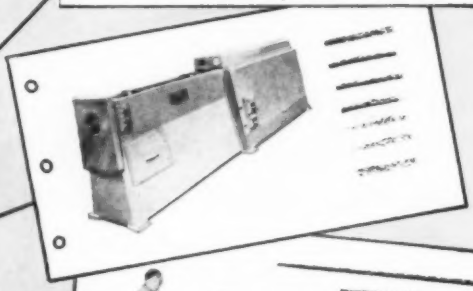
See the VUE-7

Electric Drive Pull-Up machine: broaching spiral gears, 2 at a time, at the rate of 320 parts per hour! (The world's first electro-motive powered pull-up broaching machine.)



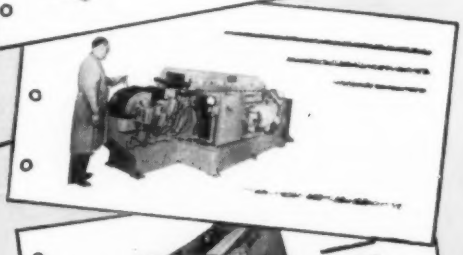
See the SRHE

Electric Drive Horizontal machine: broaching jet engine turbine discs at a speed of 280 feet-per-minute!*



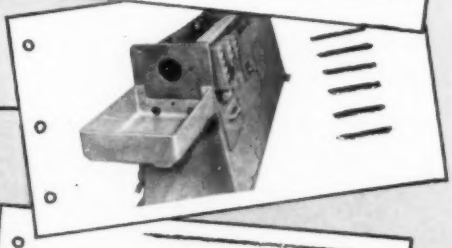
See the SPECIAL

72" Horizontal Electric Drive machine: the first of its kind for internal or external broaching. This machine is broaching involute gear sprockets, a surface broaching operation on sprocket, with 25 teeth, at rate of 25 complete parts per hour.



See the CONTINUOUS

Broaching machine: broaching automotive connecting rods at the rate of 1200 parts per hour, using 24 fixtures per machine.



See the HP-10

"Toolroom" broaching machine: broaching standard keyways in gears. (A small, universal machine, 48" stroke.)

See the SHARPENER

with micro-feed attachment sharpening and backing off all types of broaches. 36" size, with high speed spindle.

* The **fastest** broaching operation ever performed . . . finish-broaching more than 235 "pine tree" slots per hour!

THE LAPOINTE MACHINE TOOL COMPANY
HUDSON, MASSACHUSETTS • U. S. A.
In England: Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS OF BROACHING MACHINES AND BROACHES

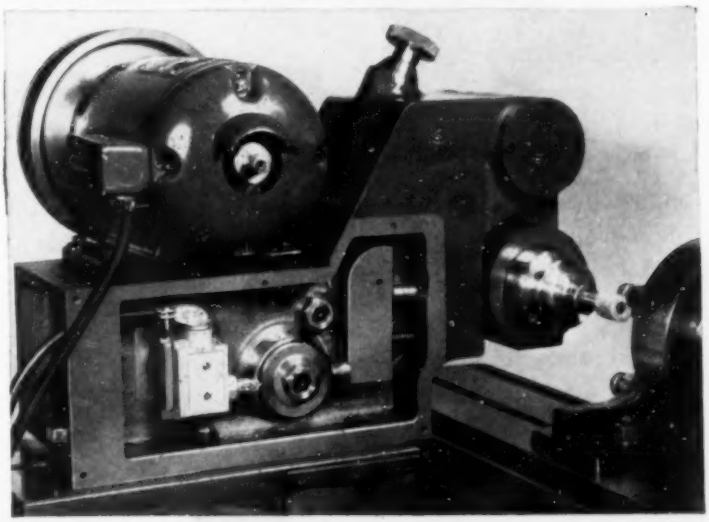
PARKER - MAJESTIC pm PRECISION MACHINES

THE SEMI-AUTOMATIC INTERNAL GRINDER

Surprisingly Low in Cost with Greater Production

A new machine developed by the makers of fine precision grinders for over a quarter of a century.

AUTOMATIC SPINDLE IN-FEED-CAM ACTUATED



Automatic sizing unit sufficiently versatile for production of one of many pieces. Accurately repeats on additional pieces after completing finished size set up on first piece. Available on either 12″ or 24″ table travel machines.

Table travel is accomplished by any one of three methods.

1. **HAND FEED**
2. **RECIPROCATOR**
3. **POWER FEED MECHANISM**

Write for Illustrated Folder

See the **PARKER-MAJESTIC exhibit** *(booth No. 415)* *at*

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

PARKER-MAJESTIC, Inc.

147 JOS. CAMPAU AVE. DETROIT 7, MICHIGAN

Don't Get Caught Without a Spindle

WHEN PRECISION DEMANDS AIR GAGING

Be protected with a SHEFFIELD ADJUSTABLE BALLJET SPINDLE KIT against an accident, an unexpected engineering revision, an oversight in a tool order. You'll be ready, too, to gage those small runs of high precision parts.

Size Setting Gage

In 5 minutes you can assemble from the Kit a spindle for any size within a range of one to three inches and set it to size with the Size Setting Gage. Four spindles of various sizes can be placed in use simultaneously.

NO MASTER SETTING RINGS NEEDED

To assemble and use these spindles, you need only an air gage and the equipment illustrated in the Kit plus a set of standard gage blocks—nothing else—not even one master setting ring. The air gage is calibrated by using the standard calibrator illustrated.

PLAY SAFE—have the Adjustable Spindle Kit on hand for daily use and ready for that emergency which may happen tomorrow.

Call your local Sheffield representative or write for Engineering Data Sheet 119-54. ***Gage Division, The Sheffield Corporation, Dayton 1, Ohio, U. S. A.***

Standard Calibrator

See us at the Machine Tool Show, Booth 1305

MANUFACTURE AND MEASUREMENT FOR MANKIND

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

EXTRA VALUE..FROM GASOLINE TO SUN'S METALWORKING OILS

Sun Oil Company makes over 400 petroleum products ...refines better value into every one of them

Sun puts the same extra value into its metalworking oils that it puts into famous Blue Sunoco—Premium Performance at Regular Price.

EXAMPLE: About ten years ago Sun became aware of a hidden source of trouble in metalworking... inadequate lubrication of the ways which support the tables or carriages during a machining operation. The costly result of this inadequate lubrication is called "stick-slip" or jumpy table. This stick... slip...stick (or jump) is often less than a thousandth of an inch...hard to detect and yet enough to cause poor finish, rejects, reduced tool life and a fall-off in production.

SOLUTION: Sun developed its now famous Sunoco Way Lubricant—a product so outstanding in its ability to overcome "stick-slip" that today, more than ten years later, it still is the standard of the metalworking industry.

RESULT: The extra value of Sunoco Way Lubricant has been proved so conclusively that it is approved by more than 55 of the country's leading machine tool manufacturers.

For EXTRA VALUE in petroleum products... buy Sun!

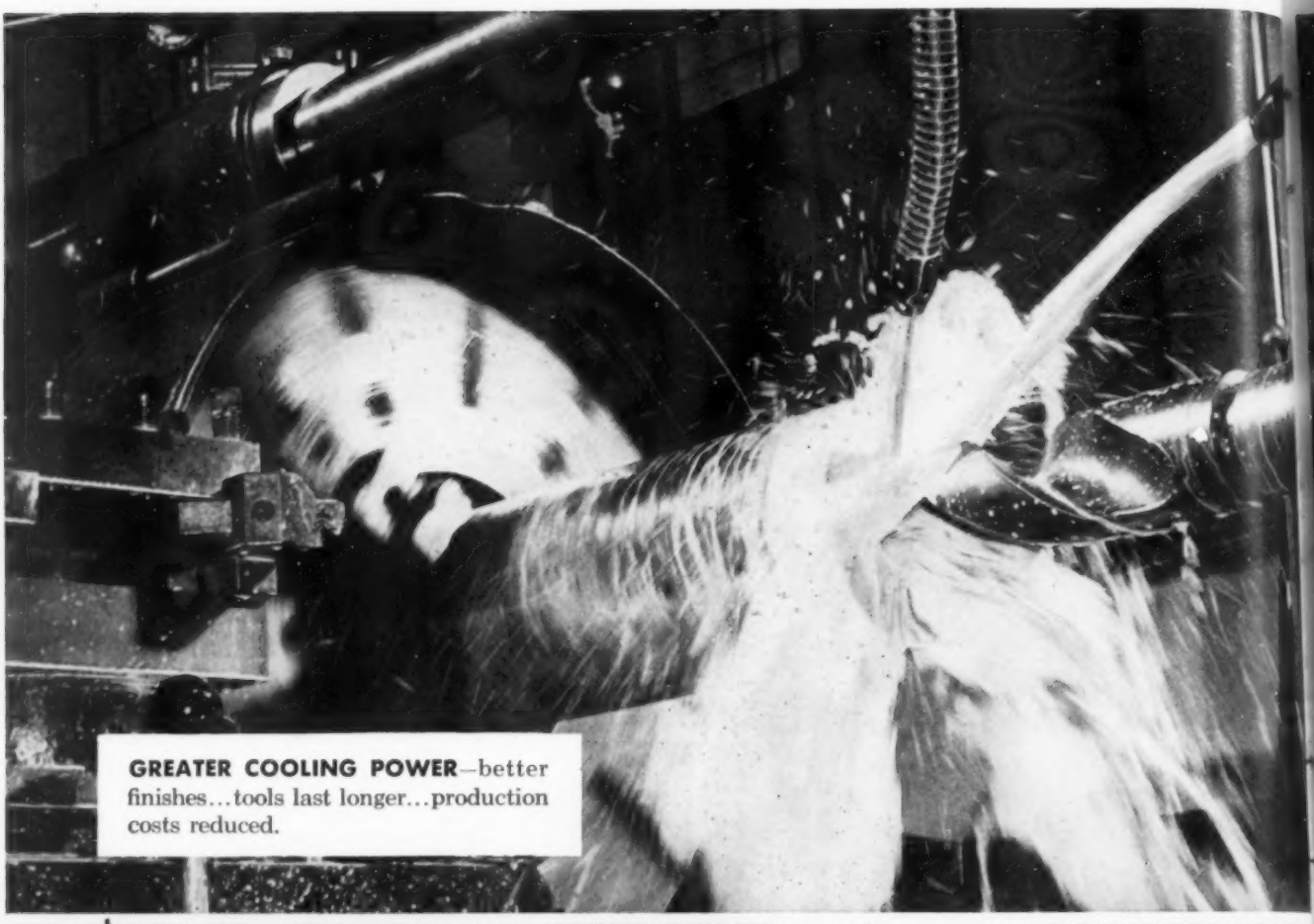
Please turn to the next page

SUNOCO

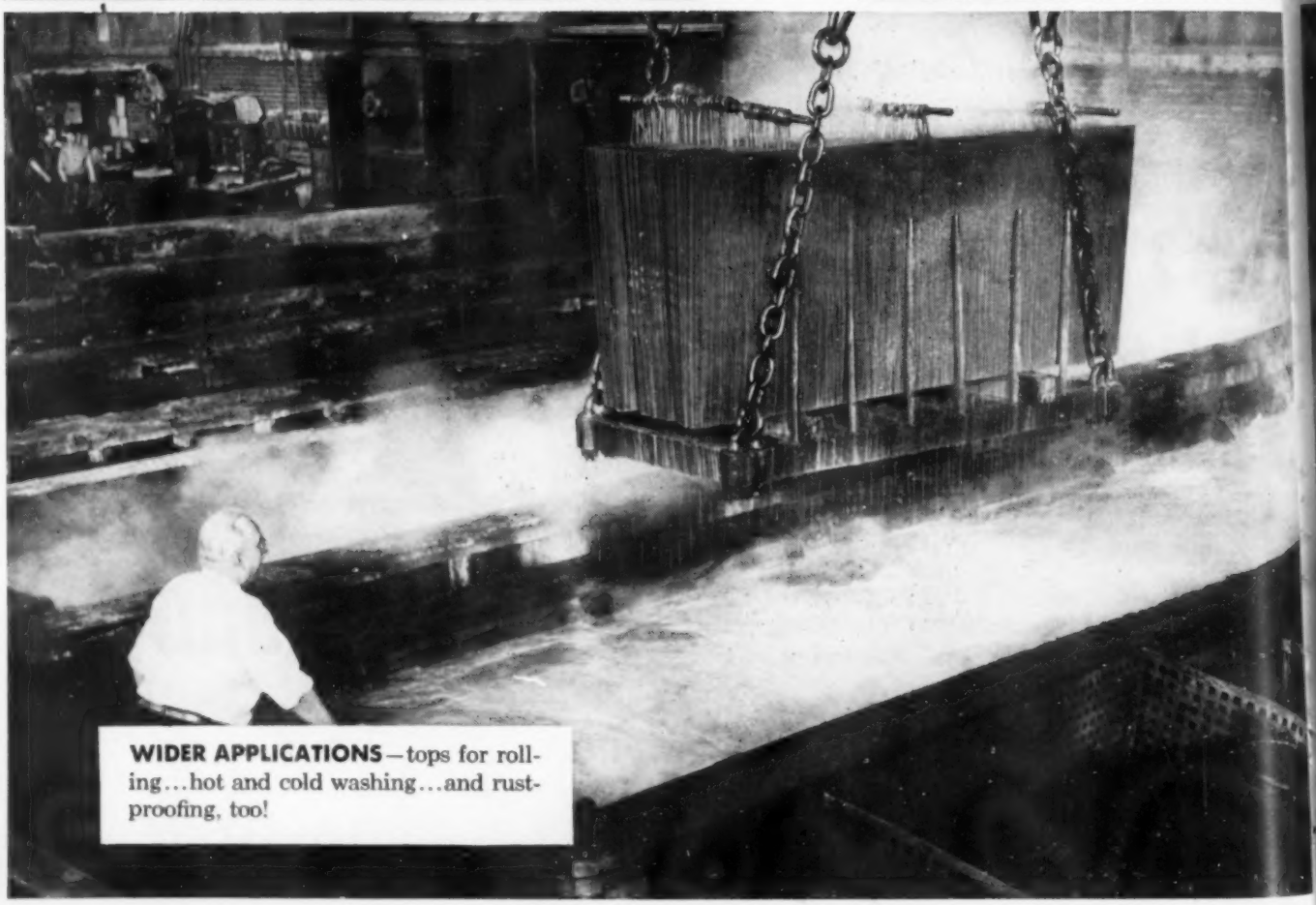
INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY PHILADELPHIA 3, PA.

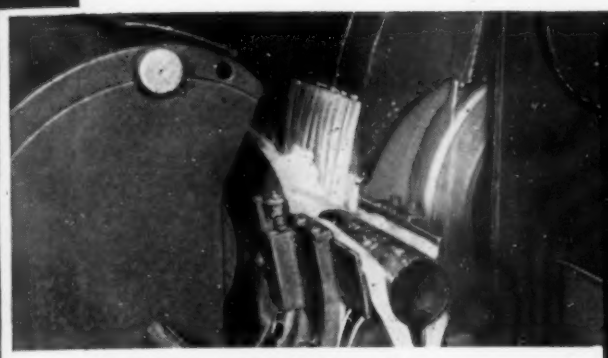
IN CANADA: SUN OIL COMPANY LTD., TORONTO AND MONTREAL



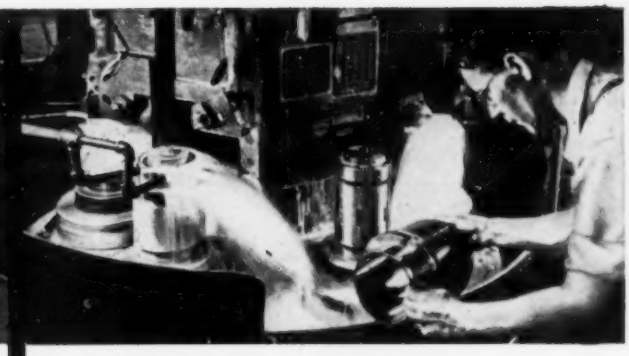
GREATER COOLING POWER—better finishes...tools last longer...production costs reduced.



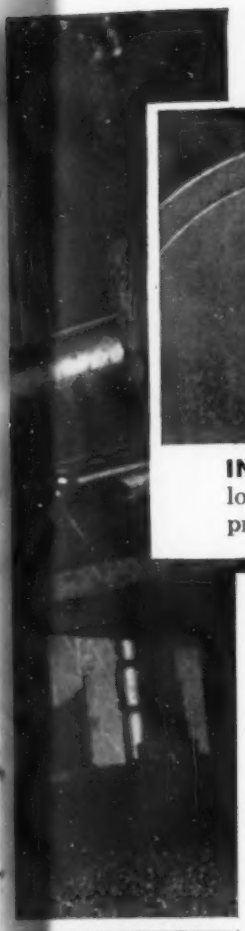
WIDER APPLICATIONS—tops for rolling...hot and cold washing...and rust-proofing, too!

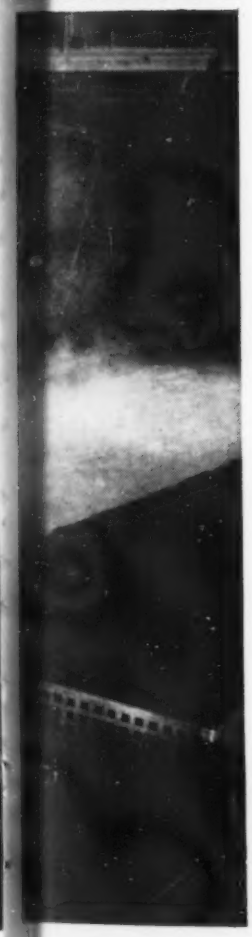


INCREASED DETERGENCY—prevents loading and glazing of grinding wheels, prolongs wheel life.



NEW S.E.C.O.—pours and mixes easily... has better operator acceptance... keeps parts and machines cleaner.





Industry's most widely used soluble cutting oil continues to give highest machining efficiency

OVER 100 MILLION GALLONS OF S.E.C.O. EMULSIONS USED IN '54

The reasons? Simple.
Primarily, industry has faith in Sunoco Emulsifying Cutting Oil. Its high machining efficiency has proven itself over a period of years. S.E.C.O. is the original 100% petroleum emulsifying cutting oil. 'Way back in 1916, machinists started using S.E.C.O.

Constantly improving in quality over the years, S.E.C.O. is now better than ever. During 1954 new refining facilities once more improved industry's most widely used cutting oil... gave users even higher machining efficiency ...better finishes... longer tool life... increased production.

Test the new S.E.C.O. in your own plant. Notice how its high detergency and purity keeps tools, parts and machines clean... how easily it mixes in hot, cold or hard water. Notice, too, how S.E.C.O. cuts operating costs... improves rolling operations, hot and cold washing, and rustproofing.

See for yourself why Sun's S.E.C.O. continues to be the leading emulsifying cutting oil in the country today. For information, call your nearest Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. TE-7.

SUNOCO

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY LTD., TORONTO AND MONTREAL

ALL ROLLING MILLS NOW USE Talide WORK ROLLS

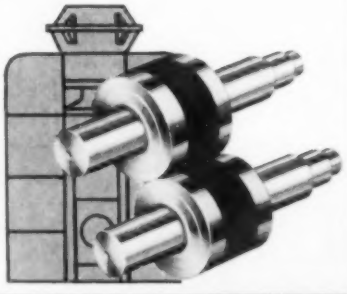
FOR EVERY TYPE FINISHING MILL

During the last five years Talide rolls have been adopted by every major strip steel producer. Metal Carbides pioneered and developed tungsten carbide rolls and successfully adapted them to all types of rolling mills including STECKEL, BLISS, UNITED, MESTA, STANAT, SENDZIMIR, WATERBURY-FARREL, TORRINGTON, RUESCH, FENN, WEAN, COLD METAL, etc.

Talide rolls have proven far superior to both steel rolls and carbide rolls of any other make.

168 to 7 hours

Leading Ohio strip steel producer averages 750 coils of various types and analyses between grinds, enabling them to operate their cold rolling mill continuously without roll changes for 7 days, 3 turns per day. Previous steel rolls used averaged 6-8 hours, necessitating 3 or 4 roll changes per day with considerable downtime.



210 to 5 days

Large Mid-Western producer of chrome-nickel alloy flat wire is averaging 7 months' continuous service between grinds compared to 5 days average run with steel rolls. Among other advantages, customer reports improved surface finish adds to sales appeal of finished product, fewer anneals are required to produce desired reduction, and wire runs cooler, resulting in less oxidation.

Talide work rolls are ultra-hard, extremely dense, and porous-free. Manufactured from highest purity tungsten carbide powders, the surface finish of a Talide roll is smoother than one micro-inch. Hard as a diamond, it will take a "bigger bite" than a steel roll. Strip steel of all analyses can be rolled down to thinner gauge, with more accuracy, greater reductions and with fewer anneals than possible with any other roll.

All users of Sendzimir rolling mills have adopted Talide work rolls because operating results have been phenomenal, far surpassing all expectations. The higher initial cost of Talide rolls is offset many times by the very substantial savings realized in less downtime, fewer regrinds, reduced scrap, reduced strain and stress load on back-up rolls, bearings and mill housings.

Tremendous production runs are commonplace with Talide rolls with mill after mill reporting increased tonnage-runs between roll changes of 278-1, 179-1, 82-1, etc. **Metal Carbides Corporation, Youngstown 7, Ohio.**

SPECIAL DIAMOND WHEEL for ROLL GRINDING

The Superset diamond grinding wheel was specially developed for grinding carbide rolls to highest possible surface finish and luster. Made of 4-8 micron size diamond dust, it imparts a surface finish far superior to any other commercial wheel. Available in sizes up to 25" diameter.

ROLL REPAIRING

Broken or damaged carbide rolls can be re-worked to first class condition with all defects eliminated at one-half original cost. Only Metal Carbides offers this service—because of its exclusive hot press method.

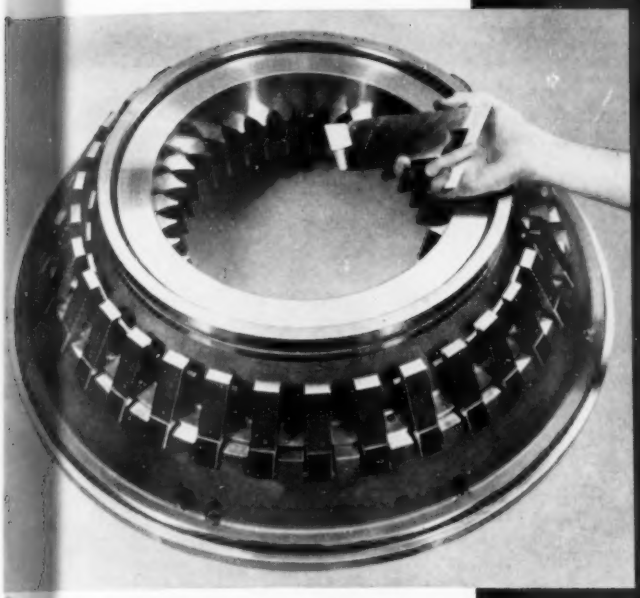
Send for new 84-page catalog 55-G

METAL CARBIDES CORPORATION
MC TALIDE®
YOUNGSTOWN 7, OHIO

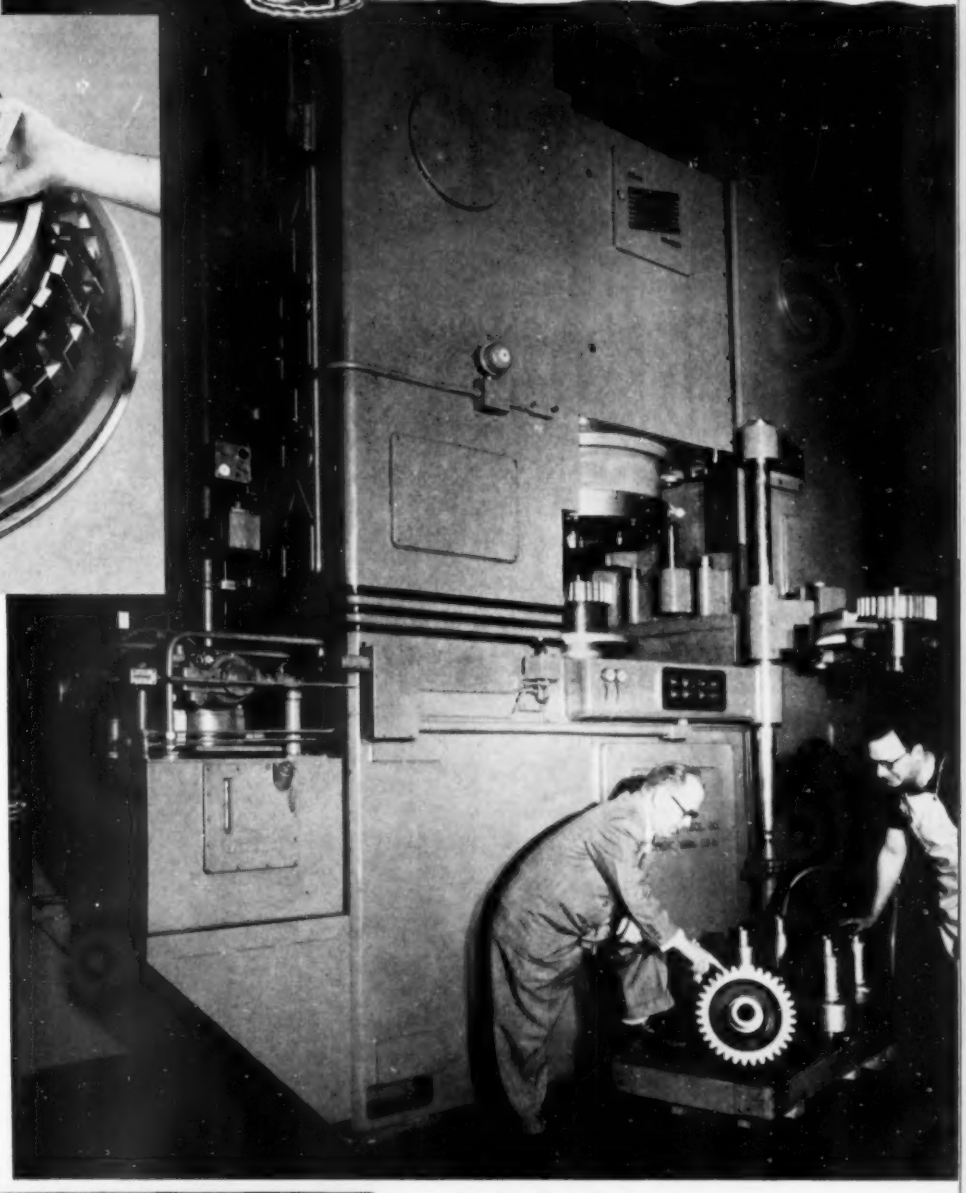
HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL · CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

This Month's

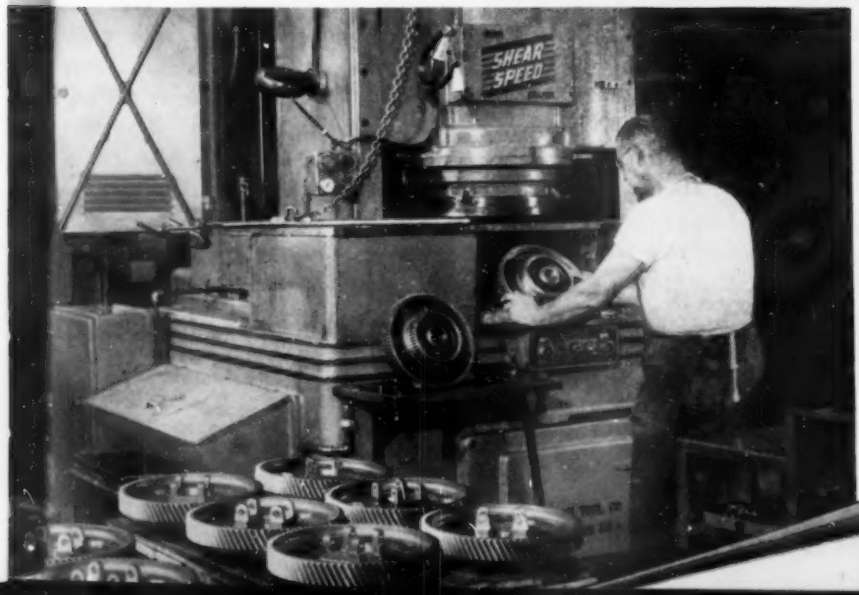
GEAR PIX



▲ RUGGED ACCURACY is built into this SHEAR-SPEED tool holder used to cut the 33-tooth bull gear in 6½ minutes on the new giant SHEAR-SPEED.



▼ VERSATILITY— Shoulder gear (7.25" dia. x 1" face) being formed on this 18105 SHEAR-SPEED gear shaper at the rate of 23 per hour, is one of 12 different tractor gears regularly produced on this fastest of gear cutting machines.

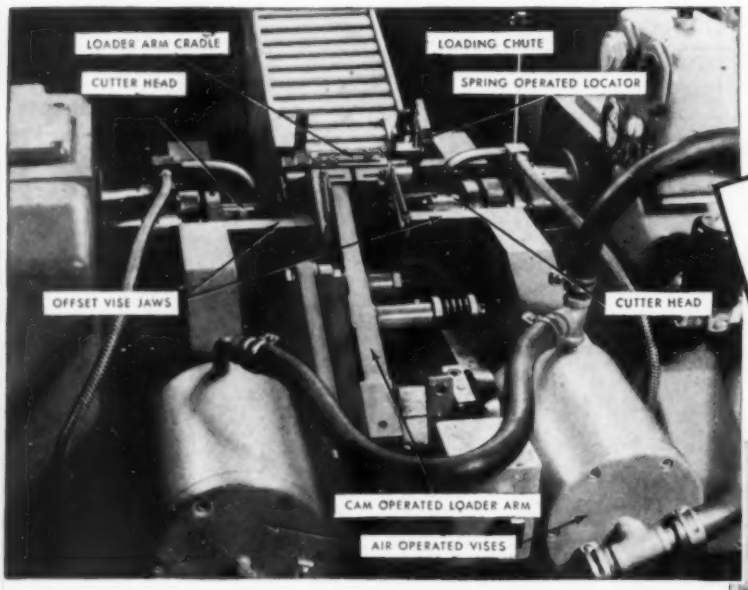


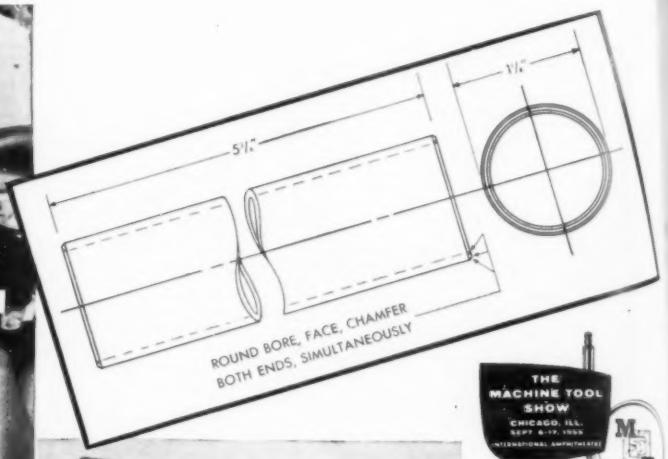
▲ VERITABLE GIANT is this new SHEAR-SPEED gear shaper. Cutting time on the tractor bull gear shown is 6½ minutes compared to 3 hours by former methods. New bulletin describes the two new SHEAR-SPEEDS with capacities up to 6" face width, 13" and 20" maximum diameters.

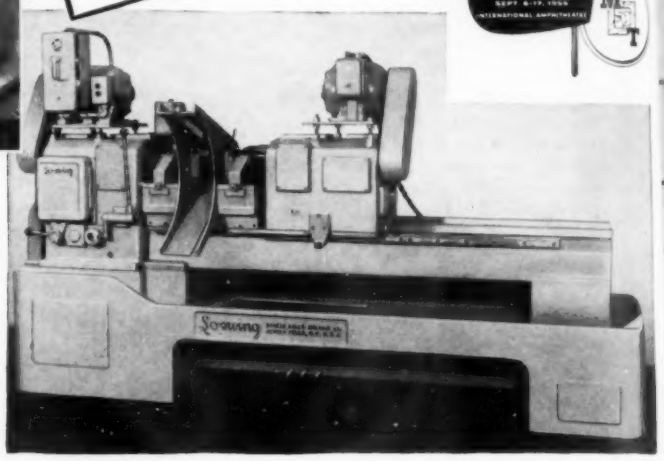
MICHIGA
TOOL COMPAN
7171 E. McNICHOLS RD. • DETROIT 12, M
IN CANADA: COLONIAL TOOL CO.,

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE Lo-swing PEOPLE" SENECA FALLS, NEW YORK







MODEL "CS" Lo-swing SPEEDS MACHINING OF SHOCK ABSORBER TUBES

Problem: **To automatically load, unload and machine both ends of Hydraulic Shock Absorber Tubes at high production rate.**

Solution: **The Model "CS" Lo-swing Automatic Drilling and Centering Machine selected for this job was equipped with an automatic loader of the type shown in the small illustration.**

The tubes, which are cut 1/16" over the required length, are fed into the upper chute, shown in the large illustration, and ejected into the lower chute after being machined. Details of the loading arm, which is cam operated, are also shown in this illustration. Tubes are fed by gravity down the loading chute into the loading arm cradle where they are properly positioned lengthwise by a spring operated locator. The loading arm then lowers the tube into the air-operated vise jaws where it is securely clamped, after which the loading arm is raised to pick up the next piece.

When the loading phase of the cycle is completed, the two revolving cutter heads advance in rapid traverse and slow down into feed just before the tools reach the work. Three cutters are used in each head . . . one cutter for facing to overall length, one for rounding the bore, and one for chamfering the O. D. The machining completed, the cutter heads retract in rapid traverse and the vise jaws open, allowing the finished part to drop into the unloading chute. The complete cycle is slightly under five seconds per piece, assuring a production of 750 pieces per hour.

Engineered jobs are our specialty. Seneca Falls is at your disposal to assist in solving your problem.

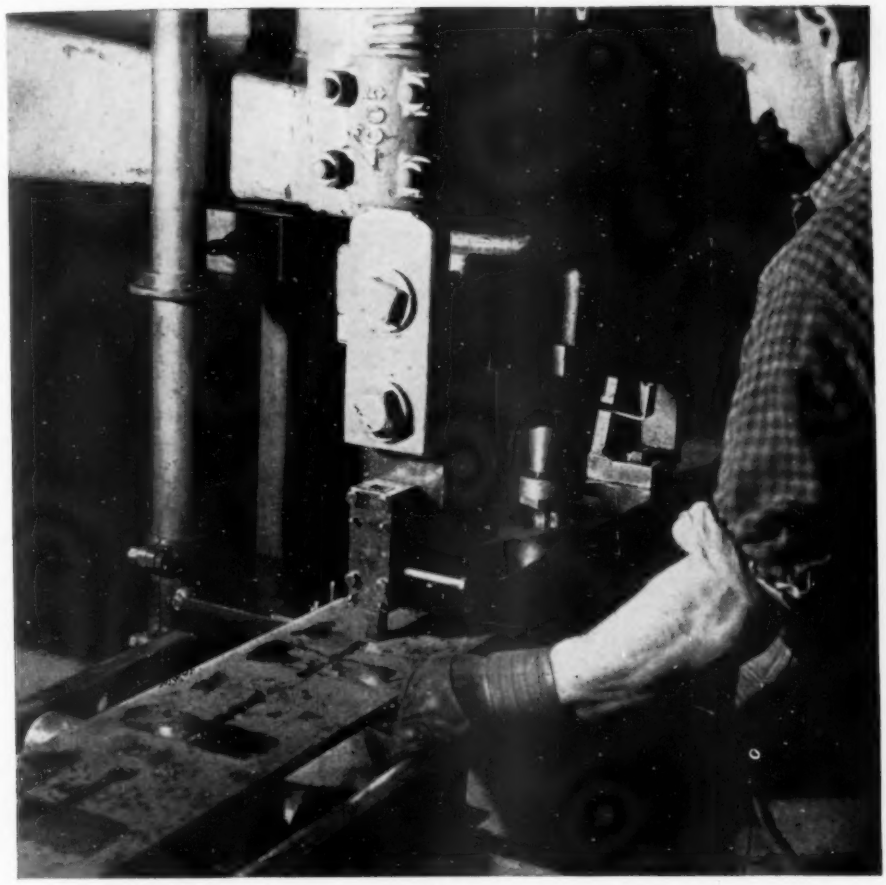
SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

Tool Steel Topics

BETH EHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



This Bearcat punch (shown above man's wrist) punches 15 square holes in each ½-in. steel plate, used as cutting edge of snow plows. Average life of punch is 5500 holes, with only three light redressings.

See What They Gained by Switching to Bearcat!

One of the operations performed in the shops of Frink Sno-Plows, Inc., Clayton, N. Y., is punching 15 holes, 11/16 in. square, in a carbon-steel plate. The plate, $\frac{1}{2}$-in. thick, is used as the cutting edge of highway snow plows. With grades of steel previously used in this punching operation, the service life of each punch varied considerably—anywhere from 300 to 1500 holes.

We felt confident that Bearcat tool steel could do better, and they agreed to give it a trial.

So Bearcat was put to work, with the punch hardened to Rockwell C56-57. Production went up immediately. Now the life of each punch is approximately 5500 holes, with only light redressing of the corners required every 1500 holes or so.

Bearcat is a tough, general-purpose air-hardening tool steel. When used in punches, its chief advantages are exceptional resistance to shock, and superior resistance to wear. Besides, Bearcat's air-hardening characteristic minimizes quenching hazards, and provides good resistance to distortion in heat-treatment.

In addition to punches, there are many other applications where Bearcat can be used to advantage: rivet sets, for example, and chisels, gripper dies, hot headers, master hobs and die-casting die inserts, to name only a few.

Why not learn for yourself how good a tool steel Bearcat really is! You can order it right now through your Bethlehem tool steel distributor. It can also be obtained from our well-stocked mill depot.

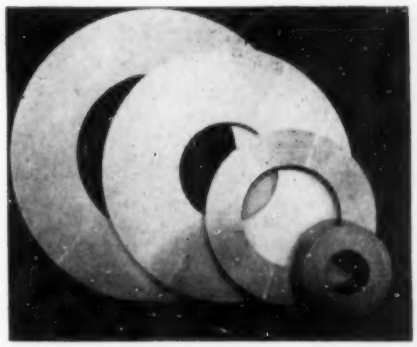
BETHLEHEM TOOL STEEL ENGINEER SAYS:

Switching Grades Won't Cure Tool Troubles

Granted that quality is of primary importance in tool steel. But there are four other factors which are also essential to the satisfactory performance of tools: (1) good design, (2) correct heat-treatment, (3) proper grinding, and (4) proper application and mechanical use of the tool.

Ordinarily a manufacturer's responsibility lies only in quality. Yet if results are unsatisfactory the user often concludes that "the steel is no good," whereas any of the other factors mentioned may be the real culprit. That is why it is so important to investigate all five of these factors. For they are like links in a chain; unless they are in reasonably good balance, trouble can be expected. When this happens, the tool and its work must be investigated thoroughly before a remedy can be suggested.

In the majority of cases, switching grades is not the answer in attempts to cure trouble with tools, for the difficulty usually lies elsewhere. Before switching grades, the user should first have a clear-cut reason for doing so, and definite objective. Otherwise, the original trouble may be intensified, rather than removed.

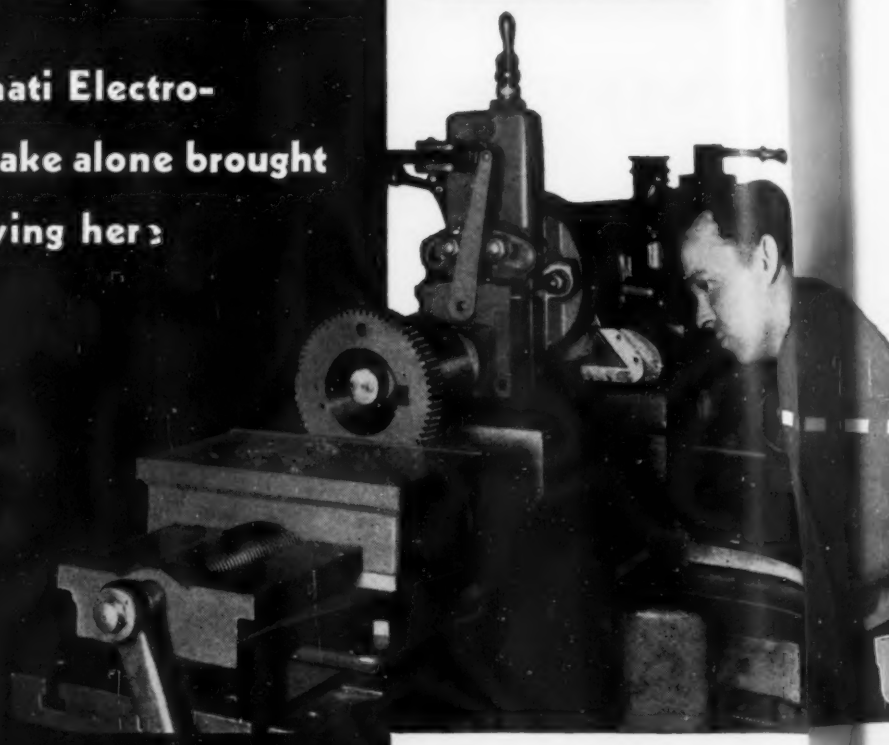


BETHLEHEM HOLLOW-BAR SAVES TIME IN RING-TYPE APPLICATIONS

If you work with ring dies, draw rings, or hardened bushings, you can save time by using Bethlehem Hollow-Bar Tool Steel, either in BTR (oil-hardening) or Lehigh H (high-carbon, high-chrome). Hollow-Bar is made by high-speed trepanning. By this process, hammer-forged or hot-rolled bars are cored out, and are then rough-turned on the outside. With Hollow-Bar, there's no need to wait for forged rings or discs.

Outstanding Time Saver....

The New Cincinnati Electro-Magnetic Clutch and Brake alone brought a 30% time-saving here



The New Cincinnati Magnetic Clutch and Brake, with its single, convenient control lever, gives the operator the fastest, simplest and most accurate control of his Shaper and converts waste time into productive time.

This powerful clutch and brake requires no adjustment, and has a long, maintenance-free life.

Write for Cincinnati Shaper Catalog N-6.

Shaping time on 7 internal oil grooves in these steel sleeves was reduced from 12.5 minutes to 8 minutes, by the Cincinnati Electro-Magnetic Clutch and Brake.

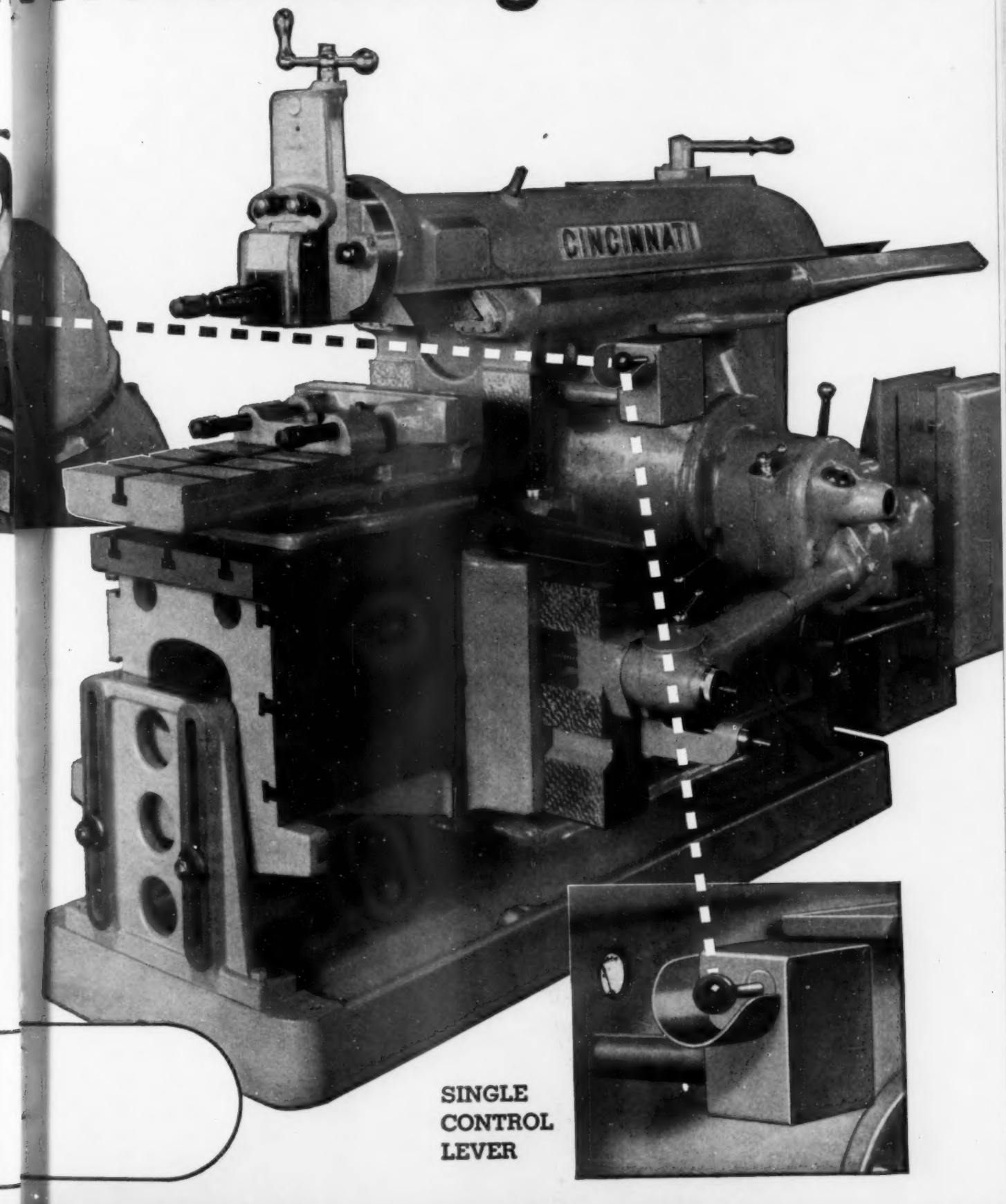
SEE
CINCINNATI
SHAPERS, SHEARS, PRESS BRAKES
BOOTH 1105

CINCINNATI

THE CINCINNATI SHAPER CO.

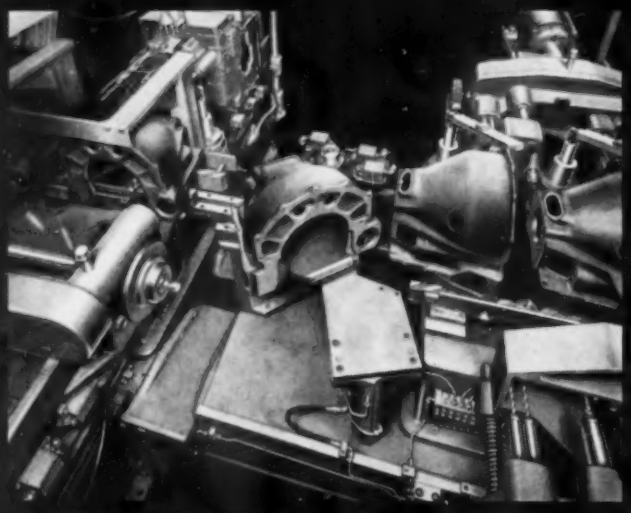
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

...Outstanding ACCURACY

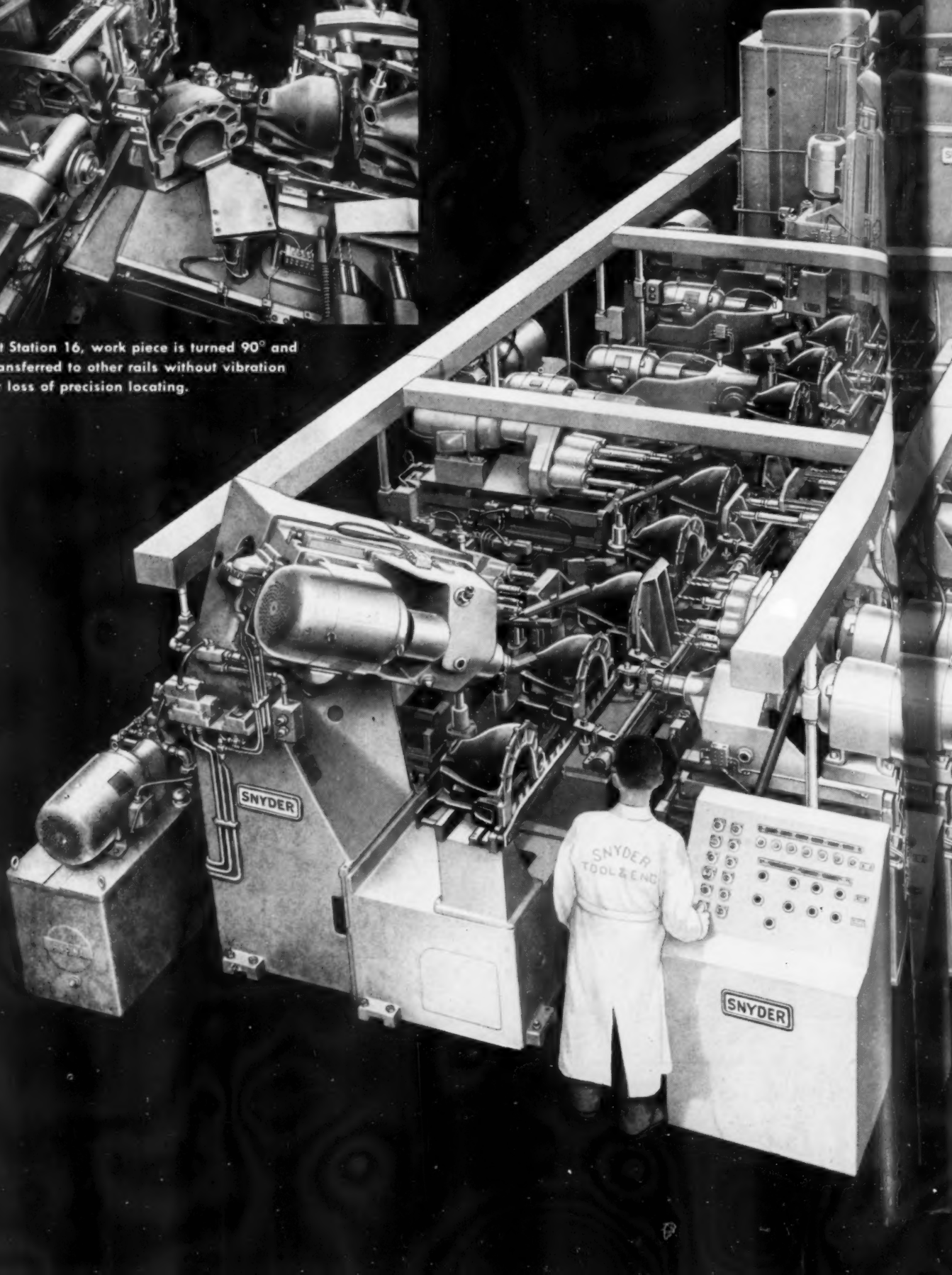


SINGLE
CONTROL
LEVER

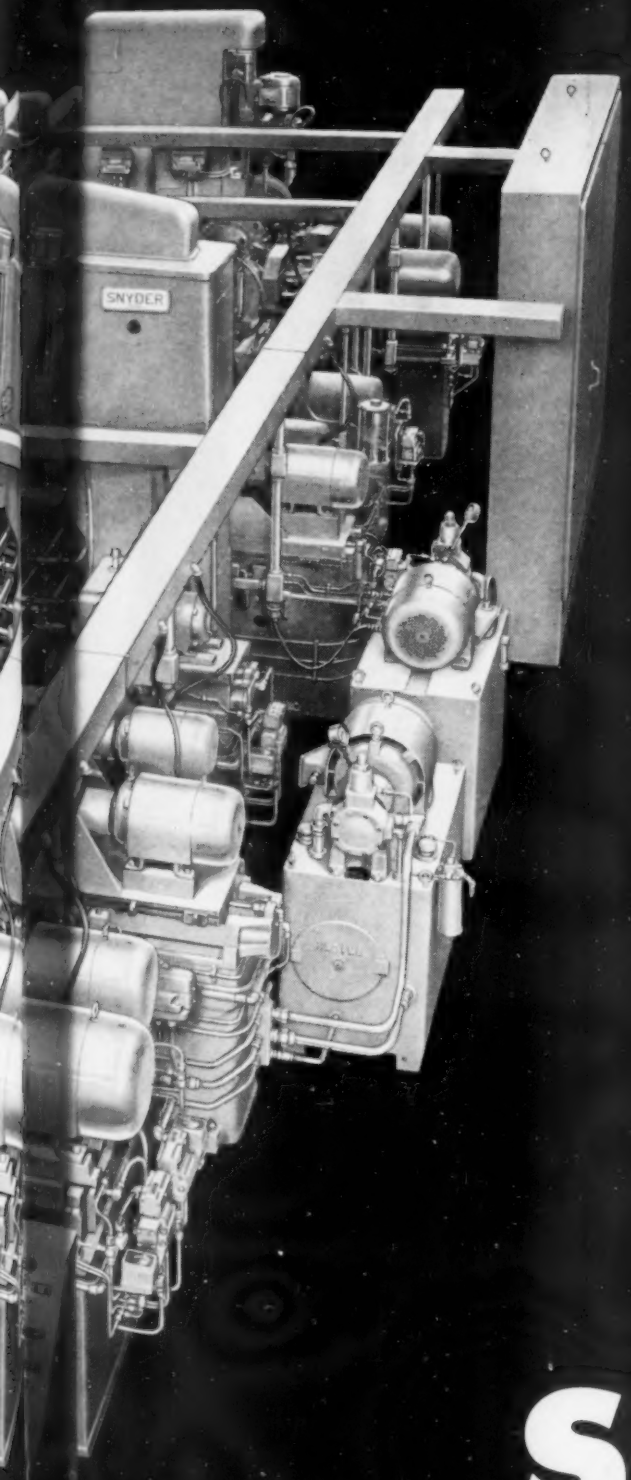
SNYDER—AUTOMATION



At Station 16, work piece is turned 90° and transferred to other rails without vibration or loss of precision locating.



LEADER FOR 30 YEARS



Presents

SNYDER SPECIAL

22-STATION automatic transfer machine for processing cast iron clutch housings; which drills, rough and finish bores, mills, saws, taps, spot-faces, counterbores and chamfers, performing a total of 110 operations on various surfaces or holes of various dimensions. Production, 124 cycles an hour at 80% efficiency.

UNUSUAL FEATURES: At Station 1, a 2" breather hole is trepanned from solid metal and finish bored with one tool. At Stations 8 and 9, a section of transfer rails cam-linked to milling units, drops to bring work piece into line with cutters. At Station 16, work piece is turned 90° and transferred to other rails without vibration or loss of precision locating.

SNYDER

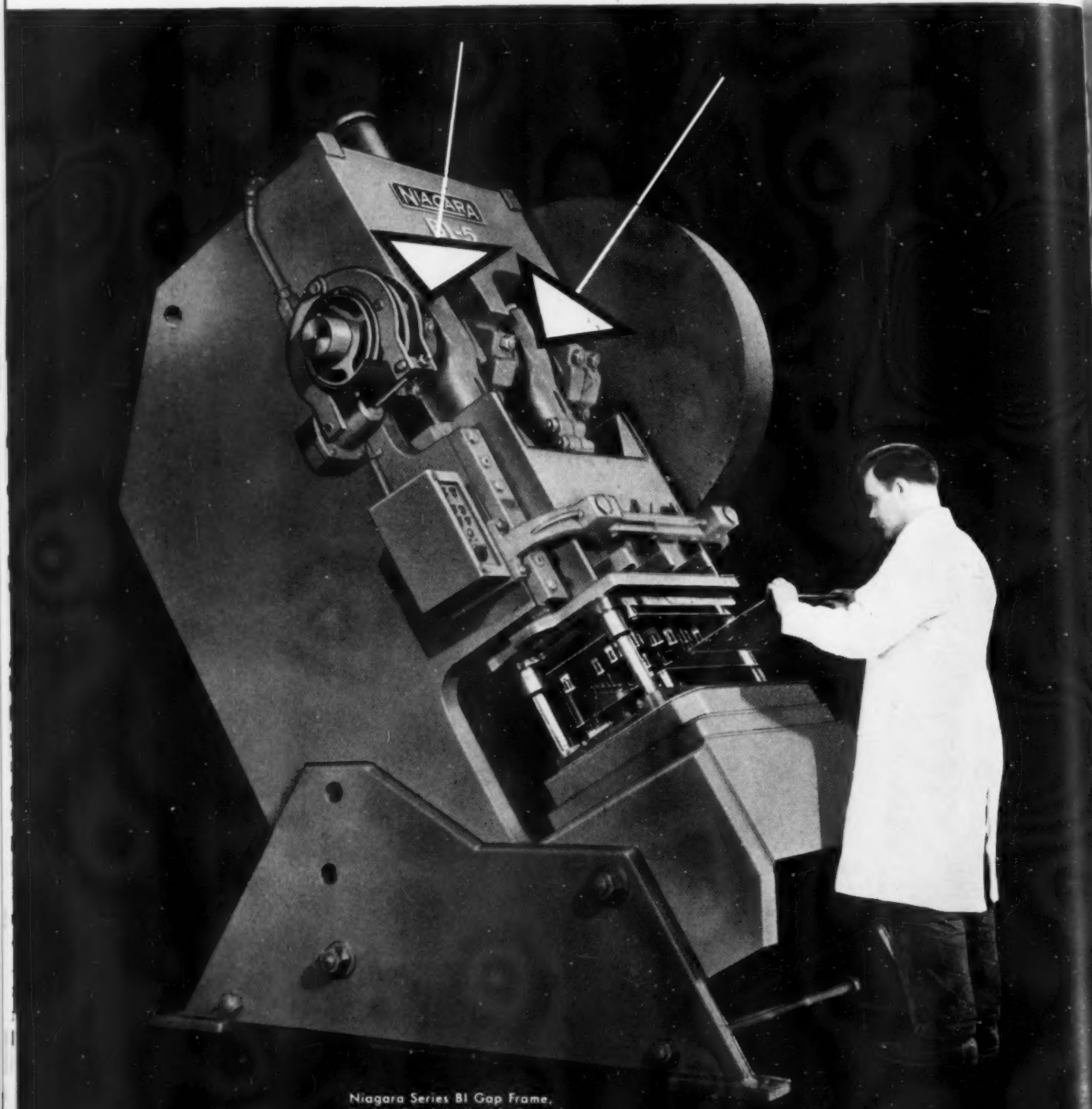
TOOL & ENGINEERING COMPANY

3400 E. LAFAYETTE, DETROIT 7, MICHIGAN

30 Years of Successful Cooperation with Leading American Industries

NIAGARA 2 POINT

tomorrow's



Niagara Series BI Gap Frame,
Double Crank Inclinable Press.

INCLINABLES

design for today's production needs*

From crown to base . . . *taking in every part and operating feature* . . . the Niagara Double Crank Inclinable Press Series stands alone in advanced engineering. By record and by reputation, this is the press with the best future for cost-cutting, production-boosting, *long die area work.*

LONGER LIFE FOR LONG DIES

Niagara's double crank design resists tilting of the slide under off-center loading, thereby reducing misalignment of dies. Rugged, welded steel plate, box type slide rigidly supports punches. Heavy duty, rigid, integrally built frame properly resists deflection, maintaining permanent alignment of bearings and slide.

FASTER WORK HANDLING

Die area is accessible from *all* sides. Work may be fed from either side or front-to-back with equal facility, and is quickly discharged by gravity through the unobstructed opening in the back when the press is inclined . . . *yes, even long work!*

GREATER VERSATILITY

A tremendous variety of blanking, perforating, forming and drawing operations can be performed, with emphasis on work requiring long die areas. All presses in the series are designed to readily accommodate pneumatic die cushions which Niagara furnishes complete with accessories and fittings.

HIGHER PRODUCTION RATE

Optionally equipped with automatic feeds and variable speed drives, Niagara 2-Point Inclinables are well suited to large quantity production and long, continuous runs.

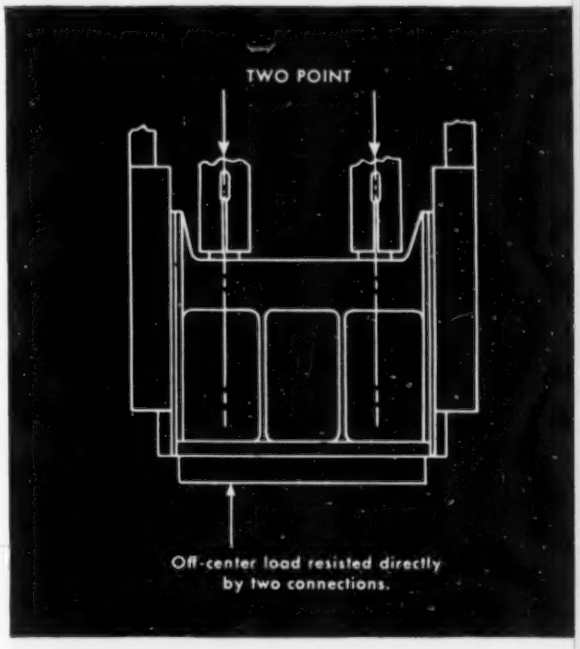
MORE ECONOMICAL MAINTENANCE

Features that spell *stamina* and *ruggedness* . . . welded steel plate frames with box section crowns and deep beds forming rigid ties between uprights; welded steel plate, box type slides; precision "V"-flat gibs; bronze bushed main bearings; self-aligning ball-seat connections; Niagara electro-pneumatic and mechanical sleeve clutches . . . all combine to keep maintenance at a practical minimum.

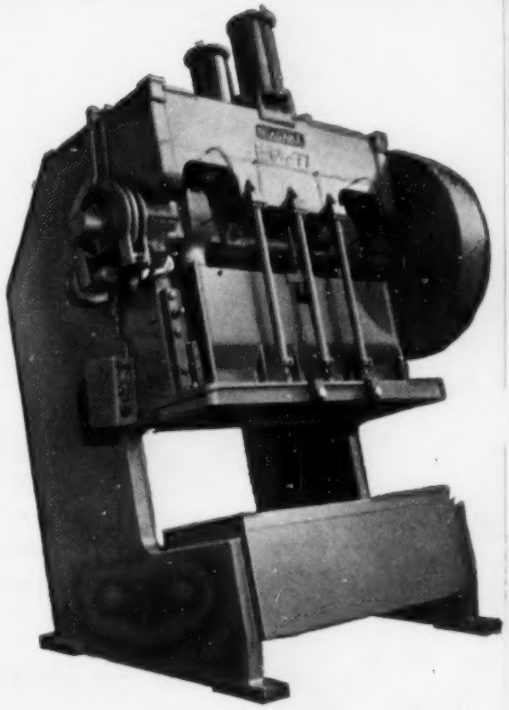
• • •

Standardized in capacities from 65 thru 222 tons, Niagara Series BI Double Crank Inclinable Presses are your most logical answer to long die area work. For still longer requirements, Niagara builds a complete line of permanently inclined or upright Series B Presses.

Obtain complete details on *all* the noteworthy Niagara features by requesting Bulletin 65. Consult with a Niagara engineer about *your* problems.



Off-center load resisted directly by two connections.



Niagara permanently inclined, gap frame, double crank press.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES: Buffalo • Cleveland • Detroit • New York • Philadelphia

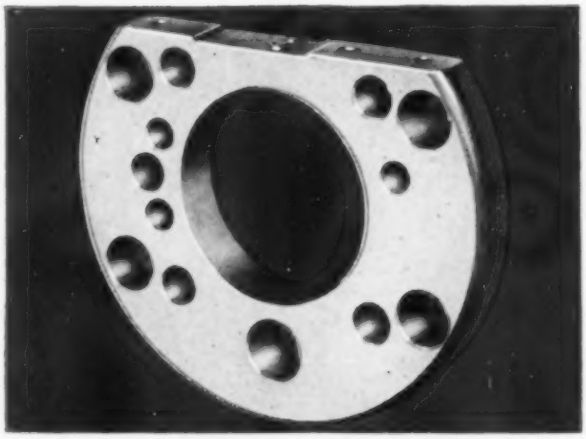
Dealers in principal U. S. cities and major foreign countries

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

REHNBERG-JACOBSON

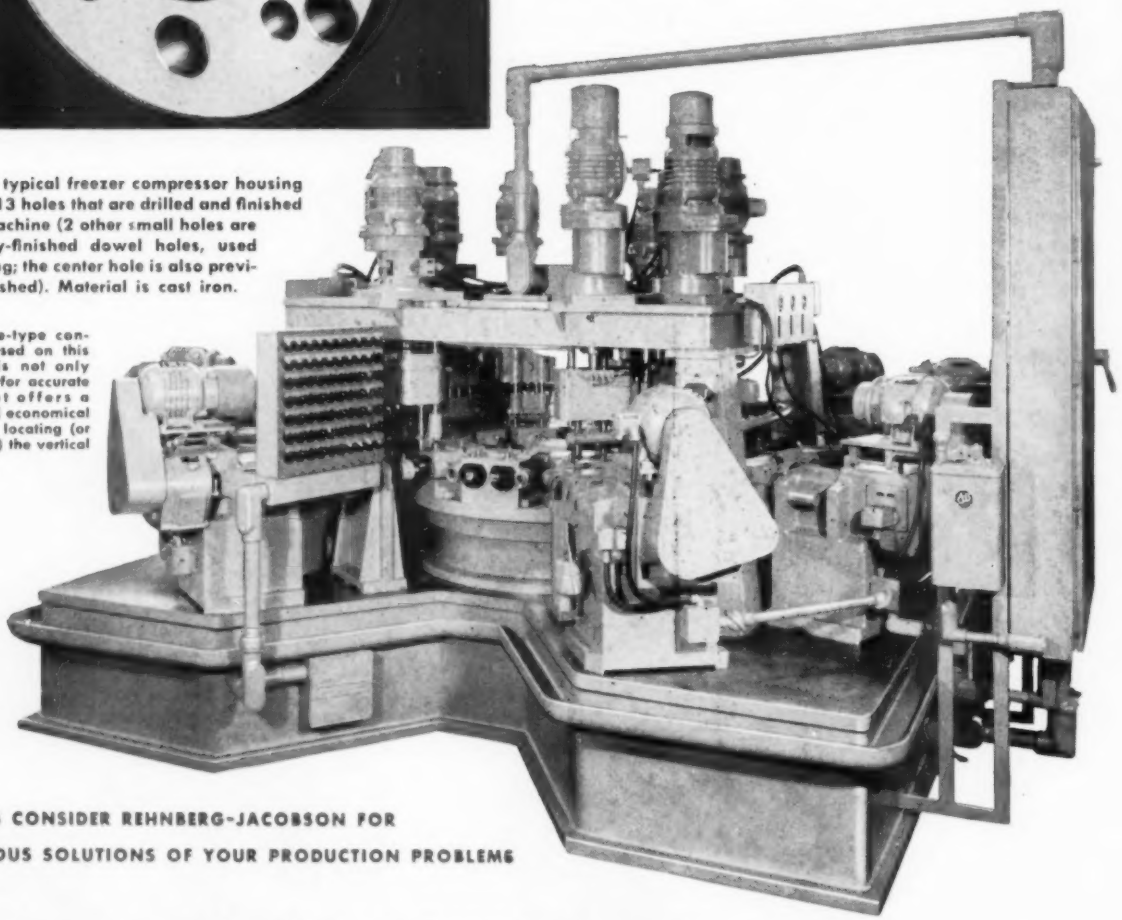
Shows the way to ...

DRILL, MILL, COUNTERSINK, AND TAP FREEZER COMPRESSOR HOUSINGS



Above, a typical freezer compressor housing showing 13 holes that are drilled and finished on this machine (2 other small holes are previously-finished dowel holes, used for locating; the center hole is also previously finished). Material is cast iron.

This 10-station BRIDGE TYPE machine has 18 R-J Drill, Tap, and Special Milling Units that work on the piece from vertical as well as horizontal directions. A lot of operations are performed, including drilling to depth, drilling through, countersinking, chamfering, cross milling, hollow milling, and tapping. The pieces go through the machine twice, first in the "A" and then in the "B" positions on the fixtures. The machine handles two sizes of housings, differing in thickness and arrangement of holes, with only a very short time required for changeover. Capacity is 264 pieces per hour.



The bridge-type construction used on this machine is not only very rigid for accurate work, but offers a simple and economical means for locating (or re-locating) the vertical Units.

ALWAYS CONSIDER REHNBERG-JACOBSON FOR INGENIOUS SOLUTIONS OF YOUR PRODUCTION PROBLEMS

Designers and Builders of Special Machinery

REHNBERG-JACOBSON MANUFACTURING COMPANY

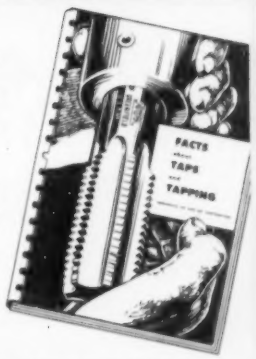
2135 KISHWAUKEE ST.

ROCKFORD, ILLINOIS

Background For Perfection

Gages do "tell the story" of perfect threads. But back of *that* story you will find holes perfectly drilled, taps properly selected and correctly used, and engineering services freely given.

When tooling any threading job, get the whole story — specify GREENFIELD cutting Tools *and* GAGES.



Write for new Greenfield Handbook —"Facts About Taps and Tapping."

GREENFIELD TAP and DIE CORPORATION
Greenfield, Massachusetts

360° hoist hook service...

WITH- AMERICAN MONORAIL PEDESTAL JIB

Here's the answer to economical local handling service to process machines, particularly beneath heavy mill type cranes... it's the American MonoRail Pedestal Jib. These jibs are recommended for capacities between 500 to 4,000 pounds, headroom 9 and 12 feet, and boom length 8 and 12 feet... a truly precision built, skillfully engineered job. Turn to American MonoRail for any overhead handling requirements. Your American MonoRail engineers will be glad to consult with you.

For any MonoRail application write for Bulletin C-1

AMERICAN OVERHEAD HANDLING EQUIPMENT

AMERICAN MONORAIL COMPANY

13133 ATHENS AVENUE • CLEVELAND 7, OHIO

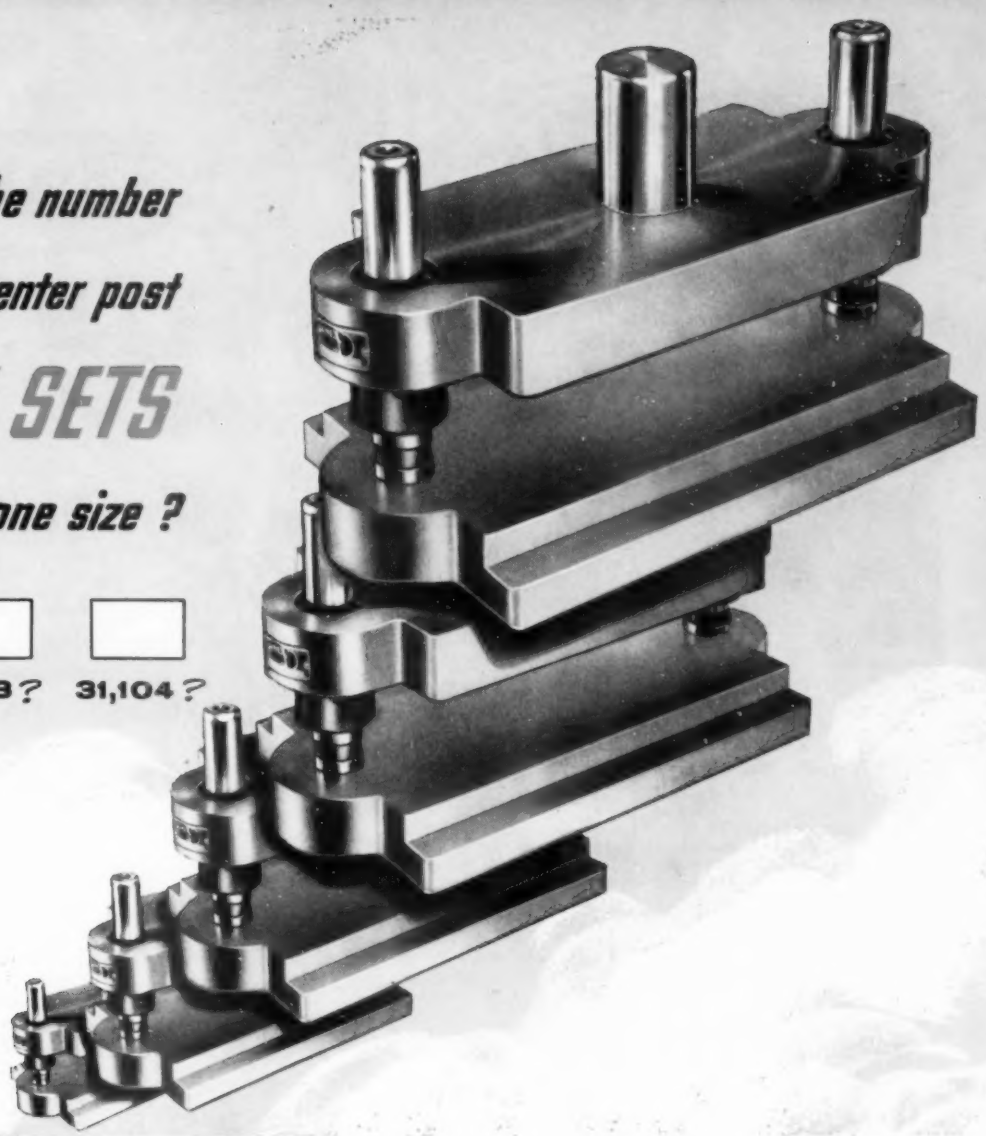
[IN CANADA—CANADIAN MONORAIL CO., LTD., GALT, ONT.]

can you guess the number of different center post

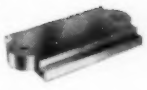
DANLY DIE SETS

in stock–in just one size ?

☐ 67 ? ☐ 575 ? ☐ 1433 ? ☐ 31,104 ?



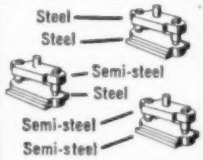
3 different punch holder thicknesses



3 different die shoe thicknesses

6 shank size variations

4 bushing type variations



3 different material combinations

16 guide post lengths in each of 3 different styles to choose from

If you guessed 31,104 different standard center post Danly Die Sets in just one size . . . then you were right! Simply multiply together all of the variation possibilities shown in a Danly Catalog for a 12x12 standard center post precision Danly Die Set, and you'll get this remarkable figure. Even more remarkable is the fact that *all* of these variations are cataloged and *stocked* in every Danly Branch.

Just how does this benefit you? This almost unlimited variety of Standard Danly Die Sets in stock at your Danly Branch is your assurance that you can always get the die set you want . . . *when* you want it. That's important in saving tooling time. So remember, when you want the best in die sets—*fast*—the place to call is your local Danly Branch.

DANLY MACHINE SPECIALTIES, INC.
2501 South Laramie Avenue, Chicago 50, Illinois

Choose the Danly Branch closest to you:

BUFFALO 7
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DETROIT 16
1549 Temple Avenue

GRAND RAPIDS
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LOS ANGELES 54
Ducommun Metals & Supply Co.,
4890 South Alameda

MILWAUKEE 2
111 E. Wisconsin Avenue

PHILADELPHIA 40
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33 Rutter Street

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SYRACUSE 4
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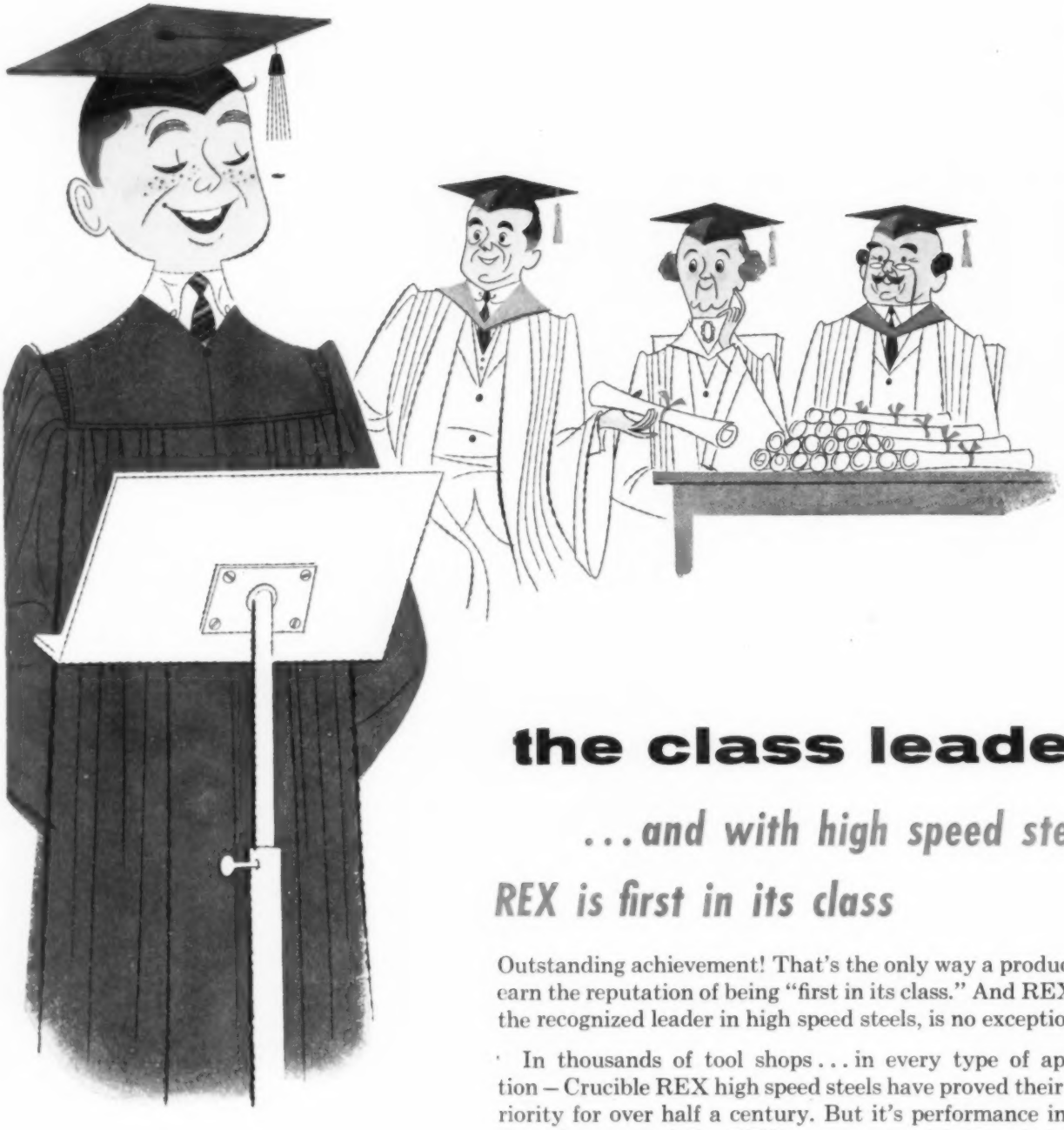
DANLY®

DIE SETS . . .
STANDARD OR SPECIAL
DIEMAKERS SUPPLIES



the class leader

...and with high speed steels

REX is first in its class

Outstanding achievement! That's the only way a product can earn the reputation of being "first in its class." And REX®, as the recognized leader in high speed steels, is no exception.

In thousands of tool shops... in every type of application – Crucible REX high speed steels have proved their superiority for over half a century. But it's performance in *your* shop that counts! Try REX on your next job. Test it for size, structure, response to heat treatment, fine tool performance. And you, too, will say REX is *first in its class.*

REX is made only by Crucible. It's available immediately from local Crucible warehouses... or by prompt mill delivery. To find out about REX and the many other types of Crucible special purpose steels, write today for "Crucible Publication Catalog." *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

"Standardize" on

IDEAL

LIVE CENTERS

Get the LIVE CENTERS You Need – When You Need Them – FROM STOCK

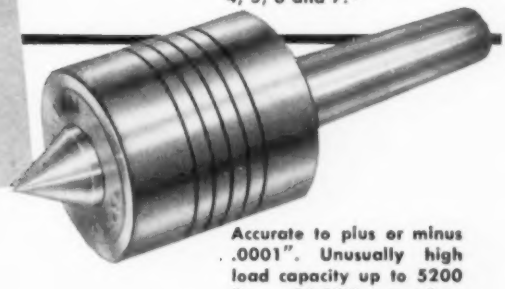
See Your IDEAL Distributor!

MULTI-DUTY

Interchangeable male, female and pipe points for centered and uncentered work. Nine sizes; Morse tapers 1 through 5, as well as straight.* Loads to 1500 lbs. at 100 RPM.

HEAVY DUTY

For your BIG jobs! For close tolerance turning on work up to 22,000 lbs. at 50 RPM. Eccentricity of less than .0002". Morse tapers 4, 5, 6 and 7.*



UNIVERSAL

Accurate to plus or minus .0001". Unusually high load capacity up to 5200 lbs. at 50 RPM means better work on a wider range of jobs. Morse tapers 2, 3, 4 and 5.*

NEW
PIPE POINT LIVE CENTER

For heavy turning work on pipes and other large, hollow cylinders. Sizes range from 3" diam. to 7½" diam. Load capacities up to 22,000 lbs. Morse tapers 3, 4, 5, 6 and 7.*

Custom-Engineered Performance in Standard Models!

When you standardize on IDEAL Live Centers, *you get custom performance in standard models.* With IDEAL Live Centers you can meet practically any live center need *right from distributor stocks* — without delay or "special" ordering or engineering. This simplifies stocking, reduces inventory investment!

The IDEAL Live Center Line includes four separate models, in a range of sizes and tapers, to cover all common live center applications. They have been proven in hundreds and hundreds of plants where they are first choice for quantity and quality output.

Your IDEAL Distributor maintains an ample stock of IDEAL Live Centers to give you the centers you need when you need them. If you have particular problems he will suggest the live center that will do *your* job best.

Whenever you need live centers — see your dependable IDEAL Distributor — *first.*

***IDEAL Live Centers are also available in Brown & Sharpe and Jarno tapers**

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The Complete Line of Live Centers
Get them from stock —
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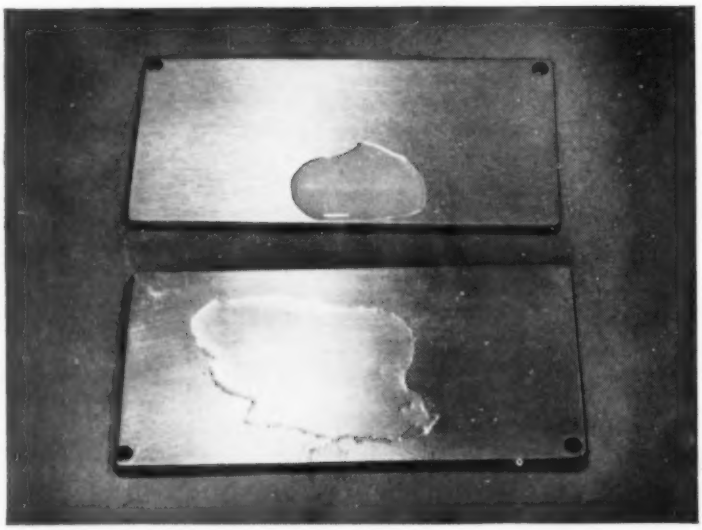
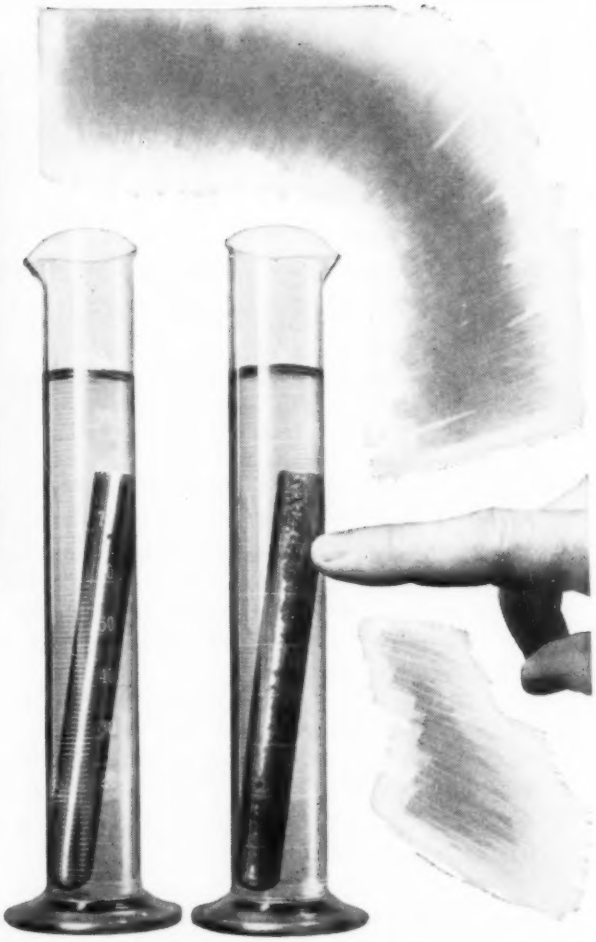
Announcing
SHELL
DROMUS OIL E





Above: Cooling action of a cutting fluid is directly related to its wetting ability. Conventional soluble oil emulsion (background) "balls" up. Equal amount of Shell Dromus Oil E spreads out thinly . . . wets far greater area.

Right: Plain carbon steel, if left in water at room temperature for about two hours, will rust as shown. Sample on left was in a 1-30 solution of Shell Dromus Oil E and water *for six months without rusting.*

SHELL DROMUS OIL E

NEW CUTTING OIL

permits higher speeds and faster feeds than ever maintained before

Shell Dromus Oil E, a new solution-type fluid, wets all metal surfaces with extreme rapidity and keeps both work and tools exceptionally cool. These qualities permit an increase of machine speeds and/or feeds far beyond anything allowable with conventional soluble oils.

IT'S MUCH EASIER ON TOOLS

There's much more life in any cutter or abrasive wheel when protected by this new oil. *It stays put* between tool and work. (At a 1-80 dilution, average tool life increase in extended field tests was about 50%.)

IT FIGHTS RUST

Shell Dromus Oil E is readily soluble in hot, cold, soft or hard water, and stable in any concentration. Even at low concentrations, it gives excellent rust protection to all ferrous metals, *including*

IT KEEPS WORK COOL

Even at stepped-up production rates, you'll find less heating and better finish wherever this new oil is used.

IT SETTLES OUT FAST

Chips and wheel particles settle out immediately . . . the recirculated fluid is clean and free from contaminating particles. It is *not* sticky or greasy . . . leaves no deposits on machines or work.

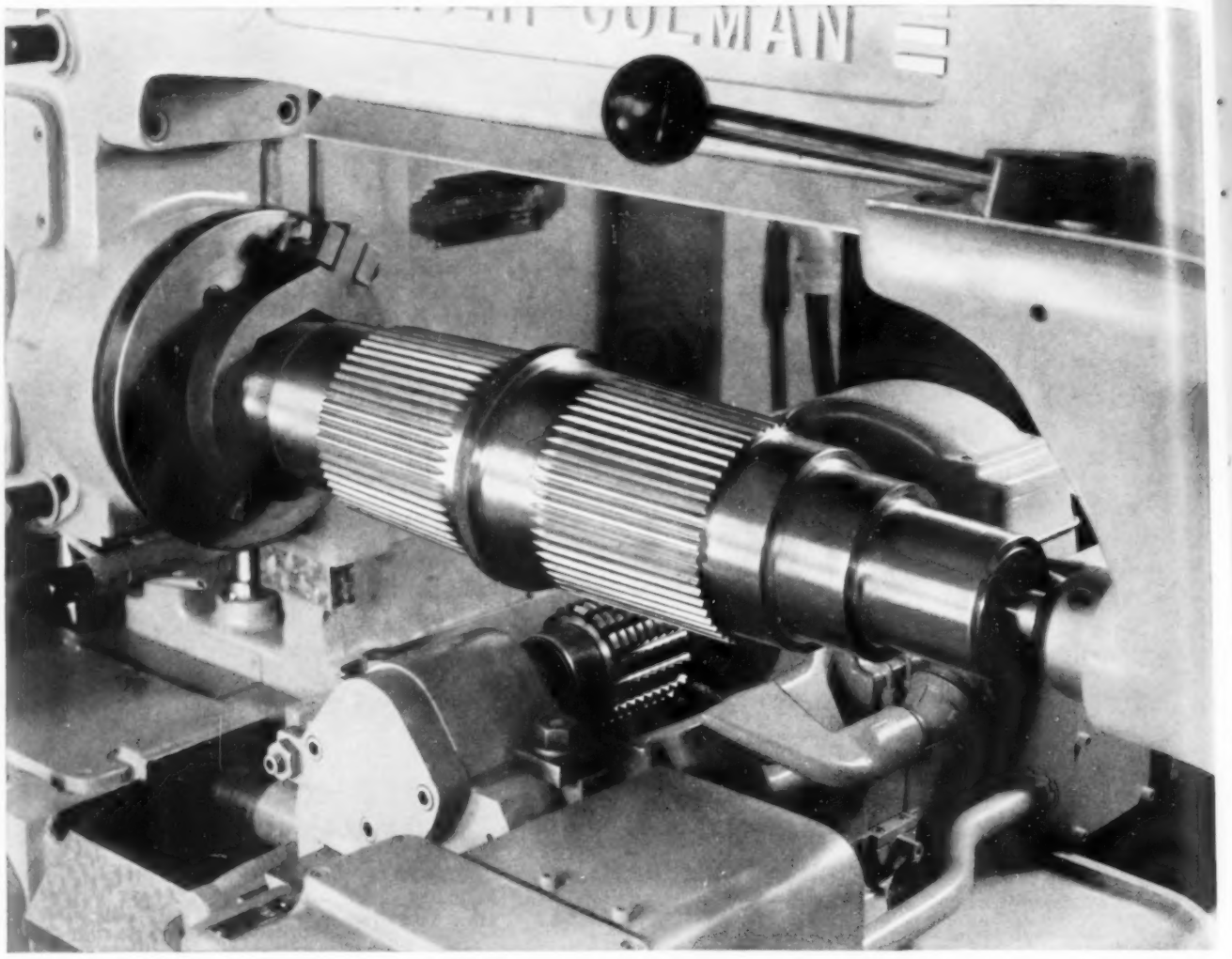
IT'S GREAT FOR GRINDING

Grinding wheels remain clean, *even when material retains a film of cutting oil from a previous operation.* Even cast iron can be ground cleanly when Shell Dromus Oil E is used to cool the work.

If all this reads "too good to be true," we suggest that you try Shell Dromus Oil E *on any problem operation you have.* It *is* that good!

SHELL OIL COMPANY

50 West 50th Street, New York 20, New York
100 Bush Street, San Francisco 6, California



HEAVY TORSIONAL DRIVE USES TAPERED SERRATIONS

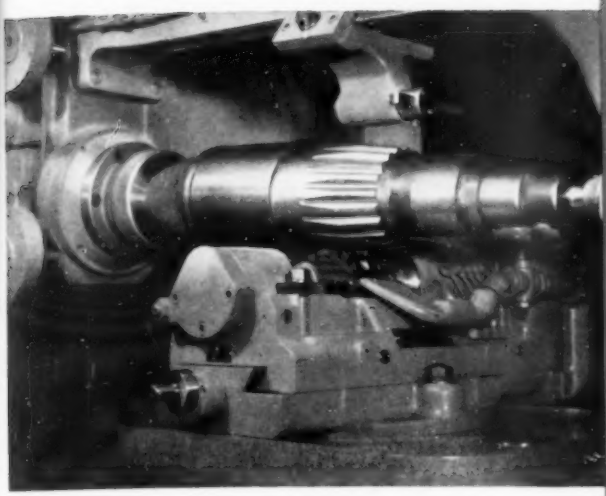
Hobbed On Specially Arranged Machines

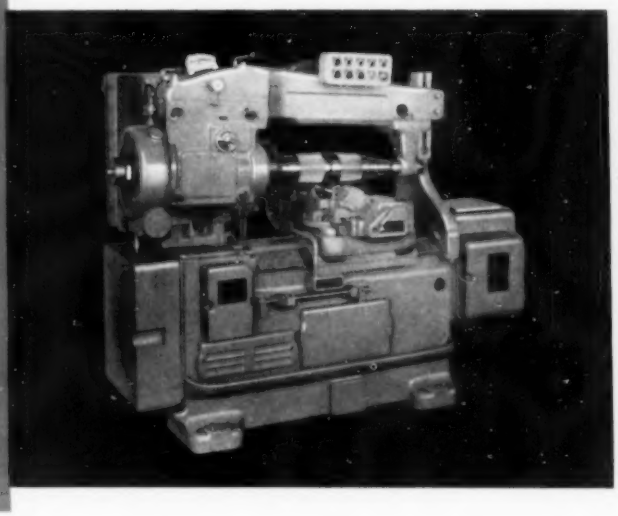
work slide and overarm swivel up to 5°

This Barber-Colman No. 16-16 Hobbing Machine is specially designed and arranged for hobbing tapered serrations. By swivelling the work slide up to 5° to obtain the desired cutting angle, several different tapers may be hobbed on the same machine. Once the proper set-up has been made, hobbing of tapered serrations proceeds according to standard hobbing technique.

Other than the special swivel arrangement on the work slide, universal joint on the worm shaft, and a cut-away outboard overarm support, this machine is of standard design and illustrates the practicability of adapting special work to standard hobbing techniques.

When not in use hobbing tapered serrations, this machine can be used for standard spur or helical gear work and straight splines. It is equipped with an Automatic Hob Shifter for maximum hob life.





metal-to-metal fit, wear compensation

Tapered serrations provide one of the best holding means for drives which have heavy and frequently-reversing torsional loads. The metal-to-metal side bearing fit eliminates relative rotation between members, and the taper provides for take-up to compensate for wear. Typical applications are heavy reversible drives such as tractor axles and hubs, and high-frequency reversible drives such as steering shafts and Pitman arms.

involute tapered serrations

Both involute and straight-sided tapered serrations may be produced by this hobbing method. The major illustration shows the hobbing of 10/20 diametral pitch involute serrations, ¾″ taper per foot O.D., 54 teeth, and 6″ major diameter. These teeth have a generated form with tapered root and outside diameter, the form changing continuously from the large to the small end. The mating part is swaged slightly undersize and the desired contact is obtained as a result of cold working the material in fitting the members. The swage is usually hobbed by the same set-up as the tapered shaft.

straight-sided tapered serrations

The second illustration shows the hobbing of straight-sided serrations using a single-position hob. These teeth are hobbed in 2-cuts and have straight sides with constant-width tooth spaces which permits the mating part to be broached to size after reaming to the correct taper. The internal mating part is broached one tooth at a time, providing a metal-to-metal fit which is not dependent upon cold working the material. Should looseness occur due to wear, it is taken-up on the tapered sides of the teeth.

Barber-Colman Engineers developed the special single-position hob for producing tapered serrations with a constant space width. They welcome special applications where this type of drive is an advantage and will be glad to furnish estimates on both hobs and machines for economically producing tapered serrations. Just send prints or samples marked for the attention of our Hob Engineers.

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 637 ROCK STREET, ROCKFORD, ILLINOIS

Hendey NO. 2E LATHE WITH ELECTRONIC

simplifies lathe operation . . .

OPERATOR EFFORT IS REDUCED TO A MINIMUM
MACHINING EFFICIENCY IS INCREASED
16-7/16" SWING OVER WAYS
COSTS ARE CUT AT EVERY TURN

Hendey electronic control of spindle speeds on No. 2E Precision Lathes is effortless with this convenient fingertip selector. It affords a quieter, more efficient drive, with closer control over speeds than is possible with other types, especially at the slower rates. Speeds are adjusted smoothly, either pre-set or while cutting, through the full range up to 1500 r.p.m. to give the most efficient cutting rate for the particular type of cut. Operating efficiency is further stepped-up by single-lever control of start, stop and reverse. Dynamic braking allows smooth and rapid changing from forward to reverse rotation of the spindle.

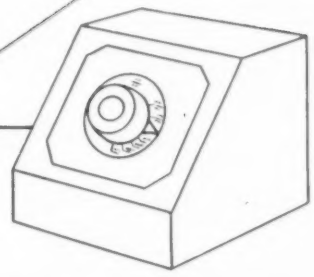
Additional Hendey quality features make this general purpose lathe a machine you should see before you buy any lathe . . . especially if you want maximum operating efficiency, work accuracy and reduced cost on turning operations.

See It In Action! Booth No. 221

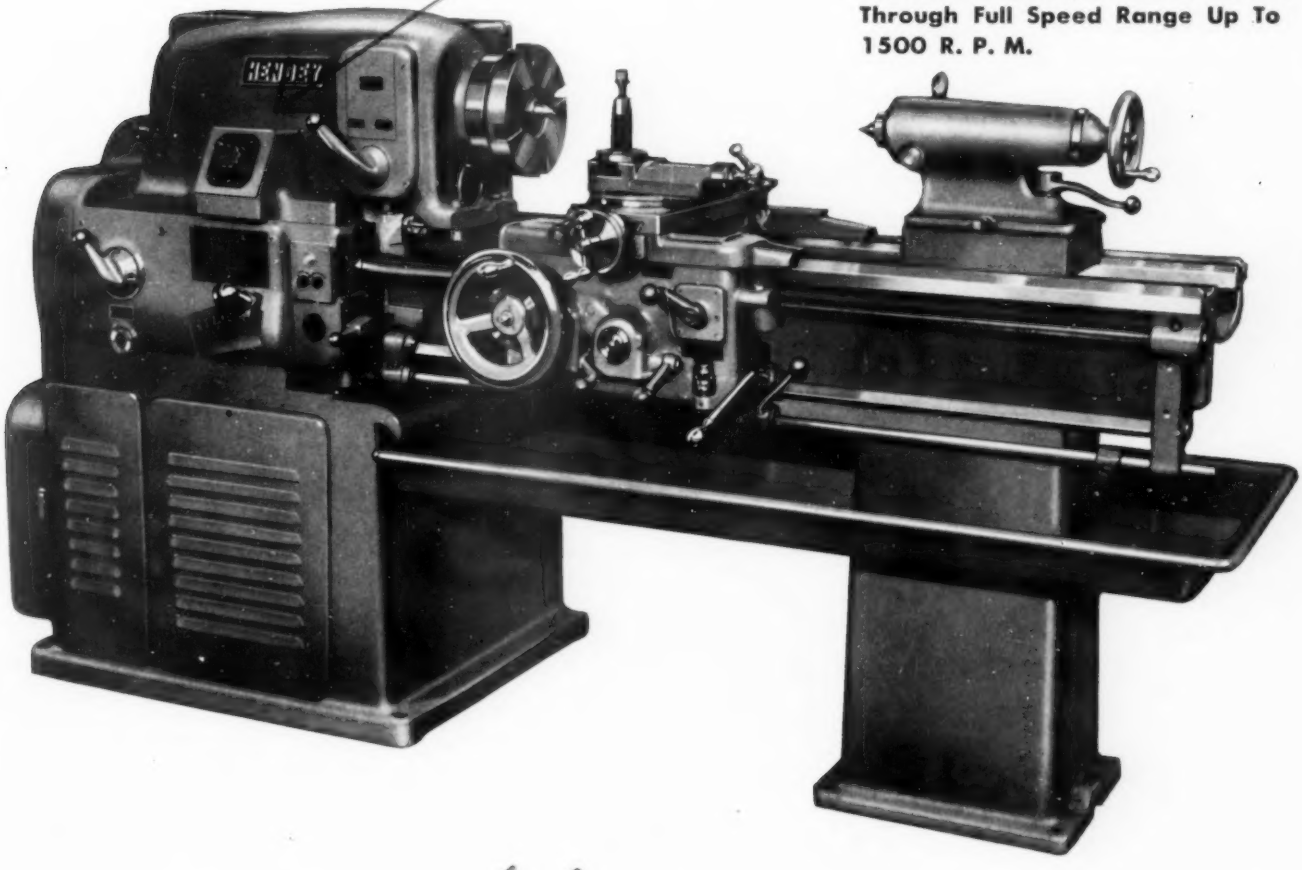
TOPS IN ACCURACY . . . HENDEY PRECISION-BUILT

SPEED SELECTOR

. . . cuts production time



Instantaneous Speed Selection . . .
. . . Pre-Set or While Cutting . . .
Provides Infinitely Variable Control Through Full Speed Range Up To 1500 R. P. M.



MACHINE TOOLS *Hendey* machine division

BARBER-COLMAN COMPANY

211 LOOMIS ST., ROCKFORD, ILLINOIS

BARBER COLMAN

"Talk about
AUTOMATION
there's a living example
FRANCHISED

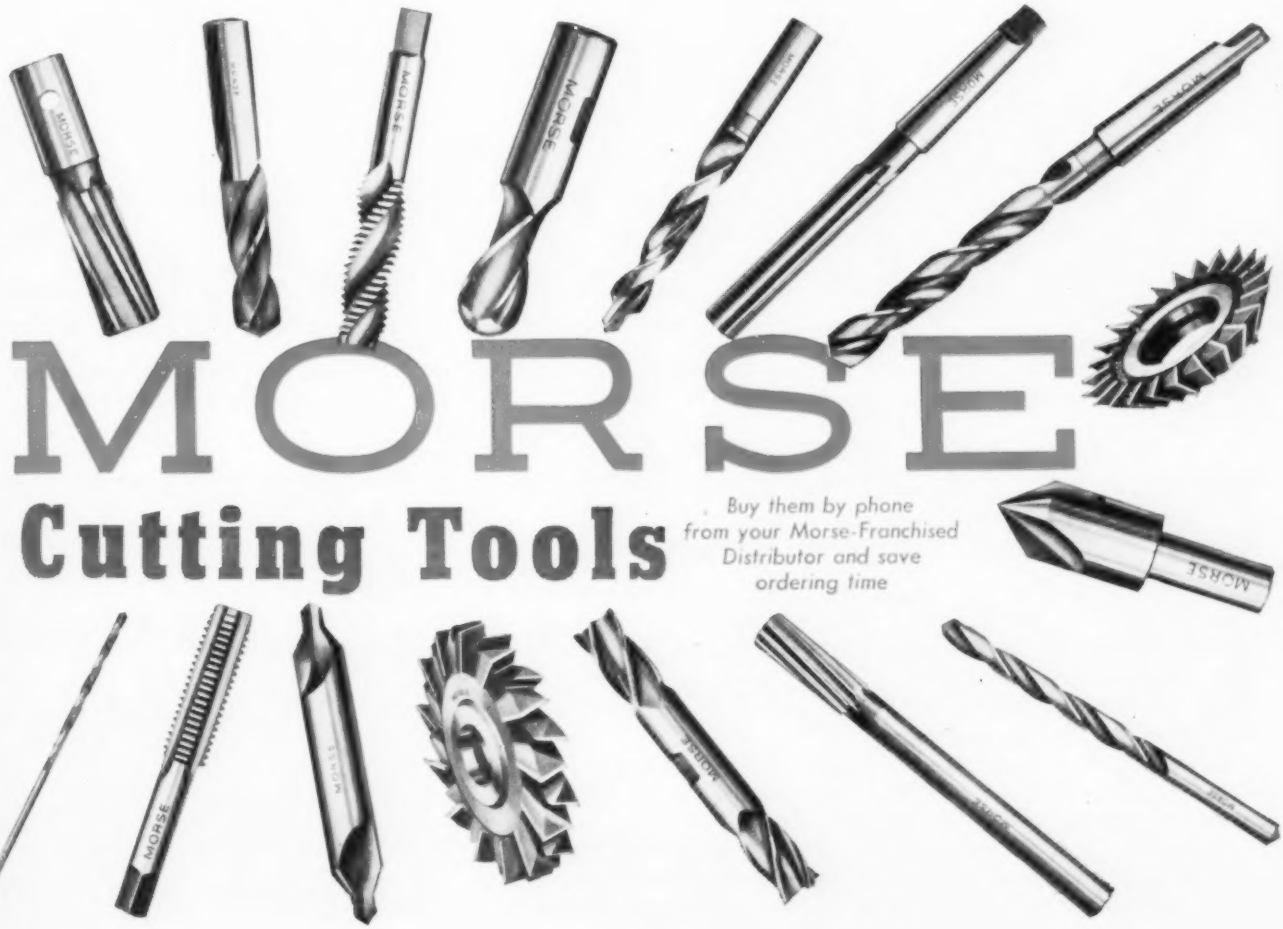
! ...my MORSE-DISTRIBUTOR"

That's right! Every Morse-Franchised Distributor knows his customers' needs so well that he keeps supplied . . . *automatically* . . . with all the Morse Cutting Tools regularly required. And if emergencies arise, he answers your call before real trouble has time to set in.

Back of him is the full Morse line . . . proved by surveys to be the full line with top acceptance in its field today. And he can give you Morse Tools plain or Electrolized . . . plus the exclusive new "Vectormatic" Ground Taps that give you more holes per dollar than you ever got before.

Yes, you can rely on the 24-hour-a-day responsibility of your Morse Franchised Distributor to keep your production up and your costs down. *Call him now while you're thinking of it.*

MORSE TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASSACHUSETTS
(Division of VAN NORMAN CO.)
Warehouses in New York, Chicago, Detroit, Dallas, San Francisco



MORE FURNACE VERSATILITY

Lindberg radiant tube is easy to change. Just turn off furnace, lift old tube out and put in new tube.

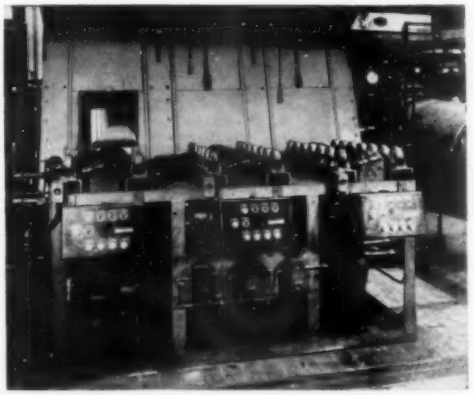
These are two of the three Lindberg gas-fired radiant tube carburizing and carbonitriding furnaces recently installed by an internationally known maker of farm machinery. With these furnaces 75% of parts are carbonitrided and 25% carburized. In addition, some bright annealing is done and the versatile Lindberg units can easily be converted for other heat treating applications.

Lindberg Vertical Radiant Tube Great Advance in Heat Treating Furnaces

When metal needs heat, Lindberg furnaces with the new Lindberg lightweight vertical radiant tube offer a better way to apply it. Industry the world over is finding that Lindberg furnaces with this new vertical tube provide a versatility no other type of furnace can give. Carbonitriding, carburizing, carbon restoration, bright hardening or annealing and normalizing are all possible with only minor adjustments.

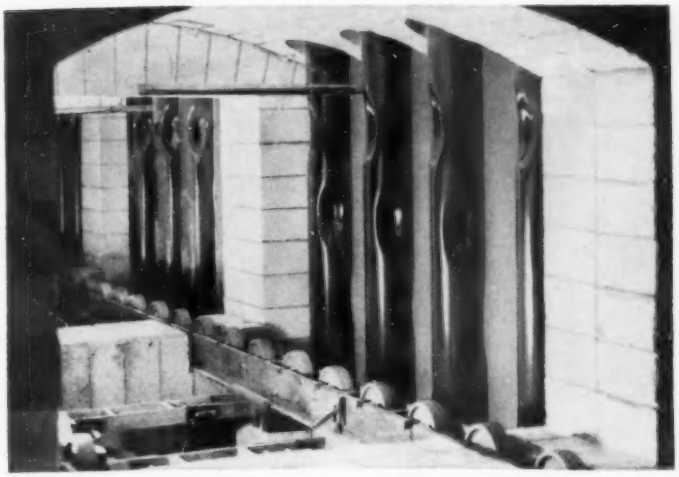
Here are some other exclusive advantages. Lindberg furnaces include a built-in pitless quench tank. Uniform case depth is assured because each charge automatically remains at heat the same length of time. A built-in purge chamber receives work loads for purging prior to heating.

Whatever type of furnace fits your production needs, from gigantic continuous pusher-type to the small manual batch-type furnace, Lindberg engineers can develop exactly the right equipment for you.



This three-row pusher Carburizer, with vertical radiant tubes between each row, was built for a large automobile manufacturer.

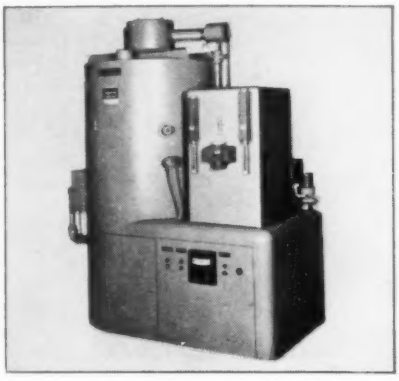
WITH LINDBERG RADIANT TUBES



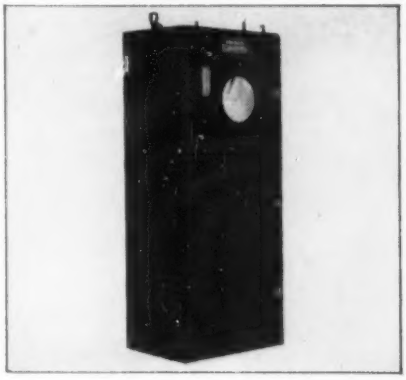
Here you can see the unique "dimpled" design of the new Lindberg vertical radiant tube. Installation is a Lindberg continuous pusher-type gas-fired carbonitriding furnace.

Revolutionary new development

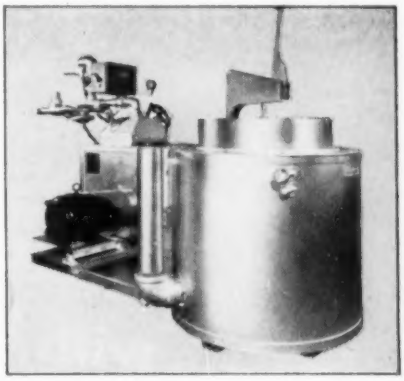
The development by Lindberg of the lightweight, easily-changeable vertical radiant tube (patent pending) is one of the most significant improvements ever made in industrial furnace design. It eliminates the bulk and bend problems of the old-fashioned horizontal tube and the uneven heat patterns inherent in earlier vertical tubes. The secret lies in the new Lindberg tube's "dimples". Here's how they work—in the radiant tube a central stream of mixed air-and-gas is surrounded by a cylindrical stream of air alone and combustion occurs in the area between these two streams. The "dimples" create eddies in the streams accelerating combustion and maintaining even temperatures along the entire length of the tube. If you aren't fully familiar with this revolutionary development ask us, or your nearest Lindberg Field Engineer about it.



This newly-designed Lindberg Hyen generator is used with Lindberg radiant tube furnaces to supply the most exacting atmospheres needed for any heat treatment.

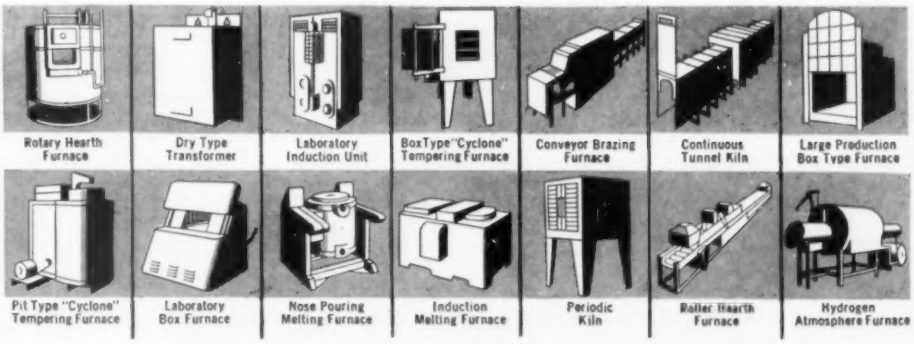


Here is the new Lindberg Carbotrol unit which automatically controls the carbon potential of furnace atmospheres provided by the Lindberg Hyen generator.



For the final step in heat treating, the famous Lindberg cyclone tempering furnace, for 20 years the standard of furnace performance. Pit or box type available.

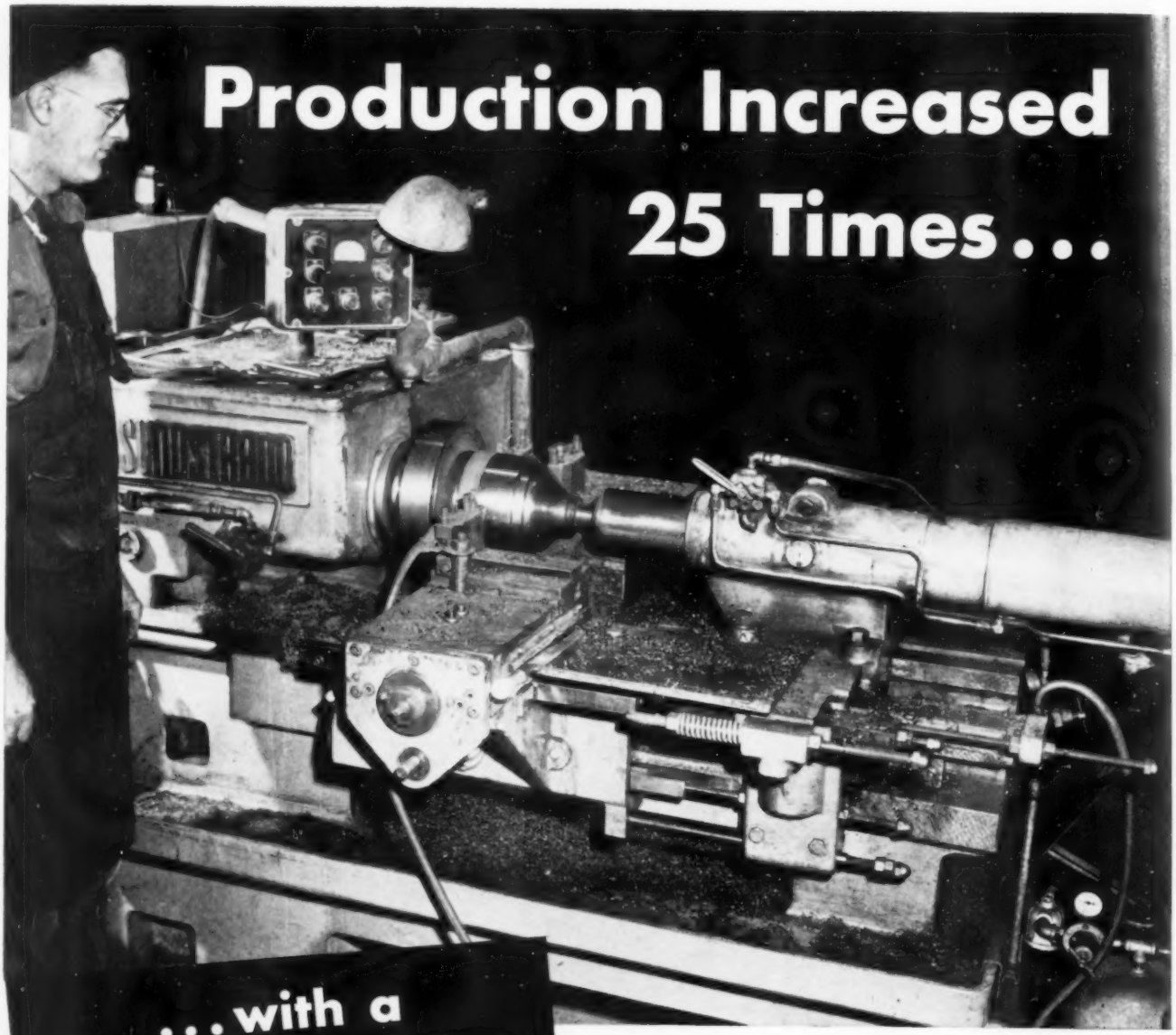
Lindberg manufactures many kinds of equipment in the industrial heating and related fields. A few of these are symbolized here. If you are interested in any of these please write us for the specifics on them, or get in touch with your nearest Lindberg Field Engineer. (See your classified telephone book.)



LINDBERG ENGINEERING COMPANY

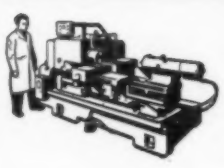
2447 West Hubbard Street, Chicago 12, Illinois

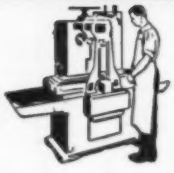
Los Angeles Plant: 11937 South Regentview Avenue, at Downey, California • **Associate Companies:** Lindberg Industrial Corporation, Chicago • EFCO-Lindberg, Ltd., Montreal, Canada • Lindberg Italiana, Milan, Italy • The Electric Furnace Company, Ltd., Weybridge, Surrey, England • Etablissements Jean Aubé, Paris, France • Lindberg Industrie Ofenbau, Gross Auheim, Germany

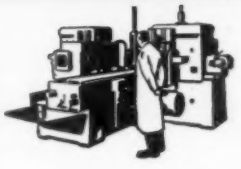


A. O. Smith Corporation increased production of stator core assemblies over 25 times with the installation of a Sundstrand Model 8A Automatic Lathe. These stator core parts, which are of silicon-iron laminations, have the outside diameter turned and the ends chamfered. With the previous method, tool life was short and the parts required a ruff and finish cut to obtain the desired accuracy and finish. With the Sundstrand Automatic Lathe and tooling method only one cut was necessary to obtain the desired finish and accuracy, while greatly increasing the rate of production.

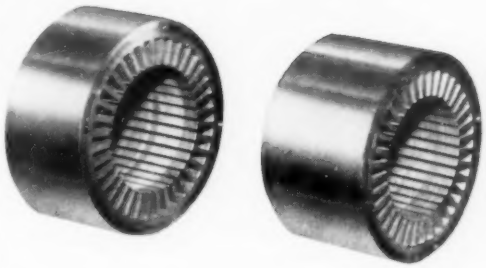
SUNDSTRAND
50 YEARS OF
"Engineered Production" Service*
*REG. U.S. PAT. OFF.
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

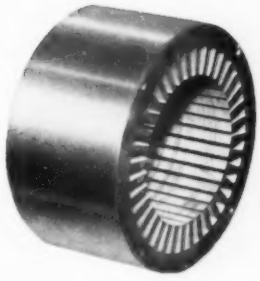






Job Data





Eight sizes of stator core assemblies are turned on the O. D. and chamfered on the ends. Parts are silicon-iron laminations ranging in size from 7½" to 8¾" in diameter and from 3½" to 6" in lengths. Lot sizes vary from 300 to 400 pieces.

Additional Data

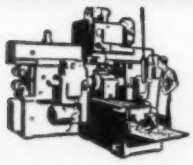
on the complete line of Sundstrand Automatic Lathes is included in this new 32-page booklet. Write for your copy today. Ask for bulletin 757.

When you want Production at lowest cost use SUNDSTRAND "Engineered Production" Service

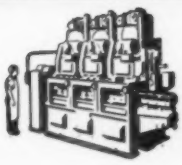
Production increases and savings like these shown for A. O. Smith are not unusual with Sundstrand Automatic Lathes. Investigate their possibilities for your work. A Sundstrand engineer will be glad to make an "Engineered Production" analysis. There is no obligation for this service.

See the new and improved Sundstrand machines in action in BOOTH 1412.

TRIPLEX RIGIDMILS



SPECIAL MACHINES



SUNDSTRAND
Machine Tool Co.
2540 Eleventh St. • Rockford, Ill., U.S.A.

you can SAVE TIME and MONEY on jobs like this with the

...GISHOLT SPEED SELECTOR!

HERE'S WHY:

No manual gear shifting! You simply turn this hand wheel or touch a trip lever (for Direct or Pre-set operation). Shifting is automatic—by hydraulic power—while the operator positions the new tools for the next cut.

It's all so much simpler with the Speed Selector. There's no need for time-wasting computations, no mental effort, no physical effort. With simple controls, either direct or prearranged, the operator gets the ideal f.p.m. cutting speed for each cut. And it's *much faster,* of course!

The Speed Selector is standard on Gisholt Nos. 4 and 5 Ram Type Turret Lathes and on all Gisholt Saddle Type Lathes.

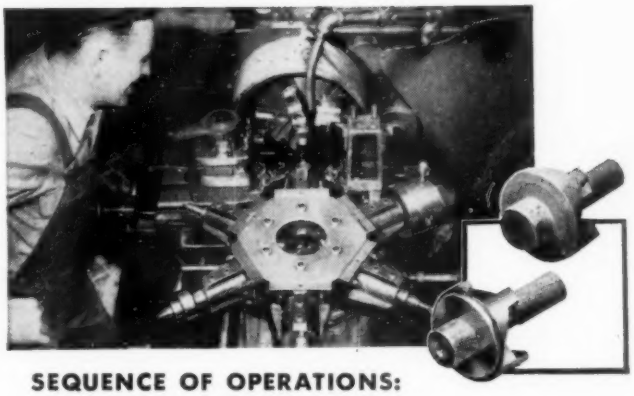
GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

HERE'S HOW:



SEQUENCE OF OPERATIONS:

Note the star which indicates each time the Speed Selector is used.

★ **1. Hexagon turret—Center drill at 297 r.p.m. hand feed**

2. Hexagon turret—Support with live center

★ **3. Square turret—Rough turn and face at 96 r.p.m., .003 feed**

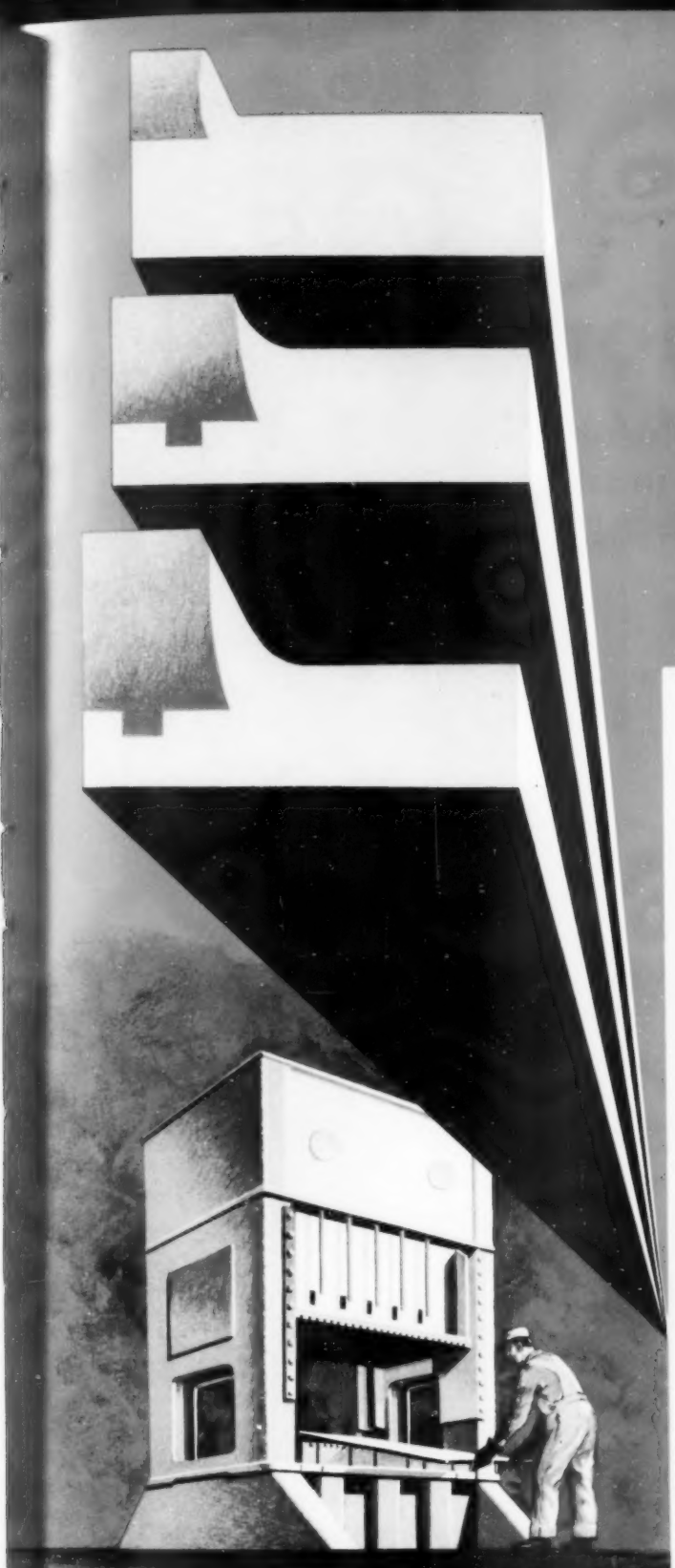
★ **4. Square turret—Finish turn, face and chamfer at 126 r.p.m. .002 feed**

★ **5. Hexagon turret—Start and drill through at 226 r.p.m., .003 feed. Trip the Hi-Lo lever, eliminating even the need for turning the hand wheel**

★ **6. Hexagon turret—Thread with tap at 39 r.p.m., leaders and followers**

—and you're ready for a new workpiece

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



Two Steels Are Fused By Jessop Skill To Bring You Better Dies At Lower Cost

One milestone in Jessop's drive for absolute supremacy in the realm of fine specialty steels is its unique ability to fuse together tool steel and tough, non-hardening carbon steel and then roll them into one solid inseparable die section. The advantages to this exclusive process are great. Forms resist shock better, and can be more readily shaped. Dowel and screw holes may be drilled after hardening, and cost per pound to you is up to 40% less than solid tool steel die sections. Whether or not you buy die sections, this Jessop "first" should interest you. A company that has the spirit and progressiveness to constantly search for new ways to serve its customers better is a good one to do business with. Send us an order for one of the specialty steels shown below.

STAINLESS STEELS • HIGH SPEED STEELS • NON-MAGNETIC STEELS • HIGH SPEED TOOL BITS • HEAT RESISTING STEELS • STAINLESS-CLAD PLATES • CARBON AND ALLOY STEELS TOOL STEELS FOR SPECIAL PURPOSES • CAST-TO-SHAPE TOOL STEELS • HIGH SPEED AND ALLOY SAW STEELS • TEMPERED AND GROUND STRIP STEEL • COMPOSITE HIGH SPEED STEELS • STAINLESS AND HEAT RESISTING CASTINGS • COMPOSITE DIE STEEL SECTIONS PRECISION GROUND FLAT STOCK • DIE STEELS—HOT AND COLD WORK

JESSOP

STEEL COMPANY · WASHINGTON, PA.

OFFICES IN PRINCIPAL CITIES

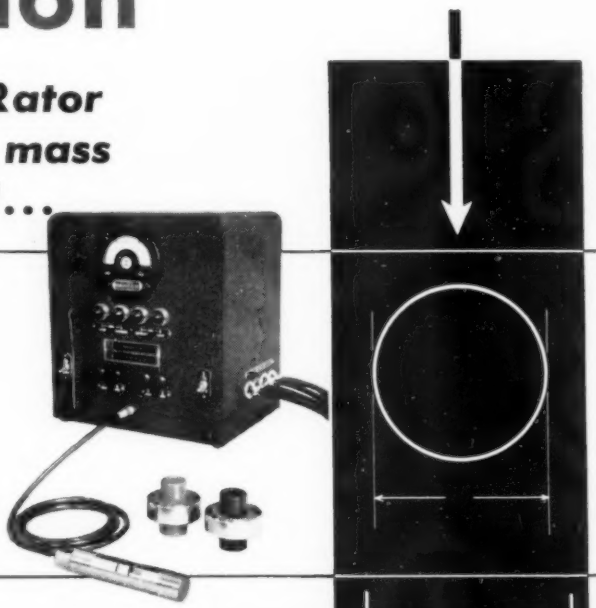
Jessop Steel of Canada Limited, Wallaceburg, Toronto

Jessop Steel International Corp., Chrysler Building, New York, N. Y.

NUMBER FOUR IN A SERIES

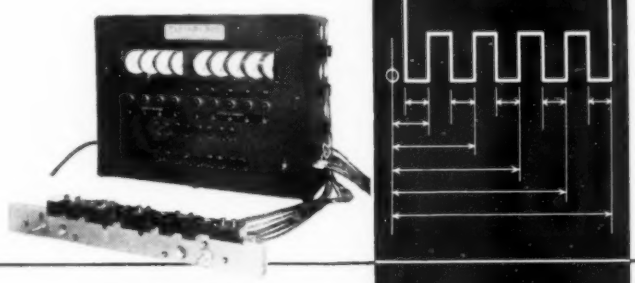
Air Gaging for Automation

Some Taft-Peirce CompAIRator Air Gage Installations for mass production quality control...



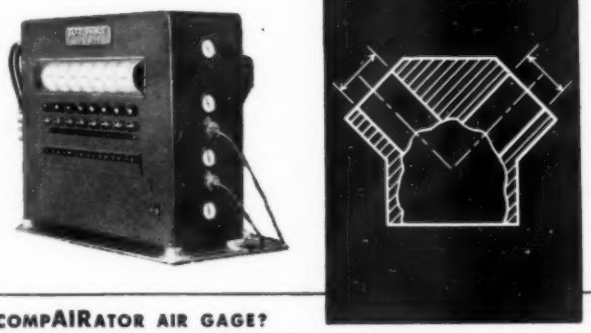
Size Control on Automatic Lathe

This T-P Air-Electric CompAIRator is attached to an automatic lathe. As parts approach tolerance limits, gaging unit sends an electrical impulse to machine, which advances or retracts cutting tool to keep parts in optimum size range. If a part is produced outside the tolerance limits, unit shuts down the machine.



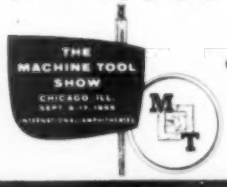
Size Control at Milling Machine

This T-P Air-Electric CompAIRator checks locations and widths of the main bearings of automotive cylinder blocks. 9 dials and lights indicate 5 bearing locations and 4 widths simultaneously. When any location or width is out of tolerance, unit automatically stops milling machine. Light indicates off-size dimension, dial reports exact size.



Size Control in Transfer Machine

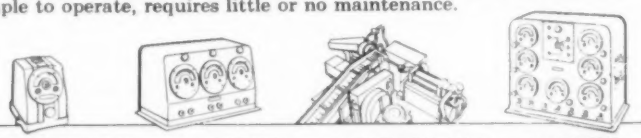
This T-P Air-Electric CompAIRator checks 8 cylinder bore diameters simultaneously in V-8 automotive engine blocks. Automatically gages the diameter of the entire length of each bore. If any bore is out of tolerance, a light points it out, and production line is automatically shut down at completion of gaging cycle. Tolerance: .002".



Get the full story at the show Booth 811

WHAT IS A COMPAIRATOR AIR GAGE?

A CompAIRator is a sensitive gaging instrument that measures variations in the velocity of tiny jets of air. When work is placed over these jets, air flow is restricted and its velocity reduced. Any change in air velocity reflects a change in part size, which is immediately shown on a calibrated indicator. Since only air contacts the part in most cases, there is minimum wear on gaging members. Fast, accurate, dependable, a T-P CompAIRator is simple to operate, requires little or no maintenance.



STANDARD AND SPECIAL COMPAIRATORS | COMPUTING COMPAIRATORS | AUTOMATIC SORTING MACHINE | AIR ELECTRIC COMPAIRATORS

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

MICROBORE

by DE VLIEG

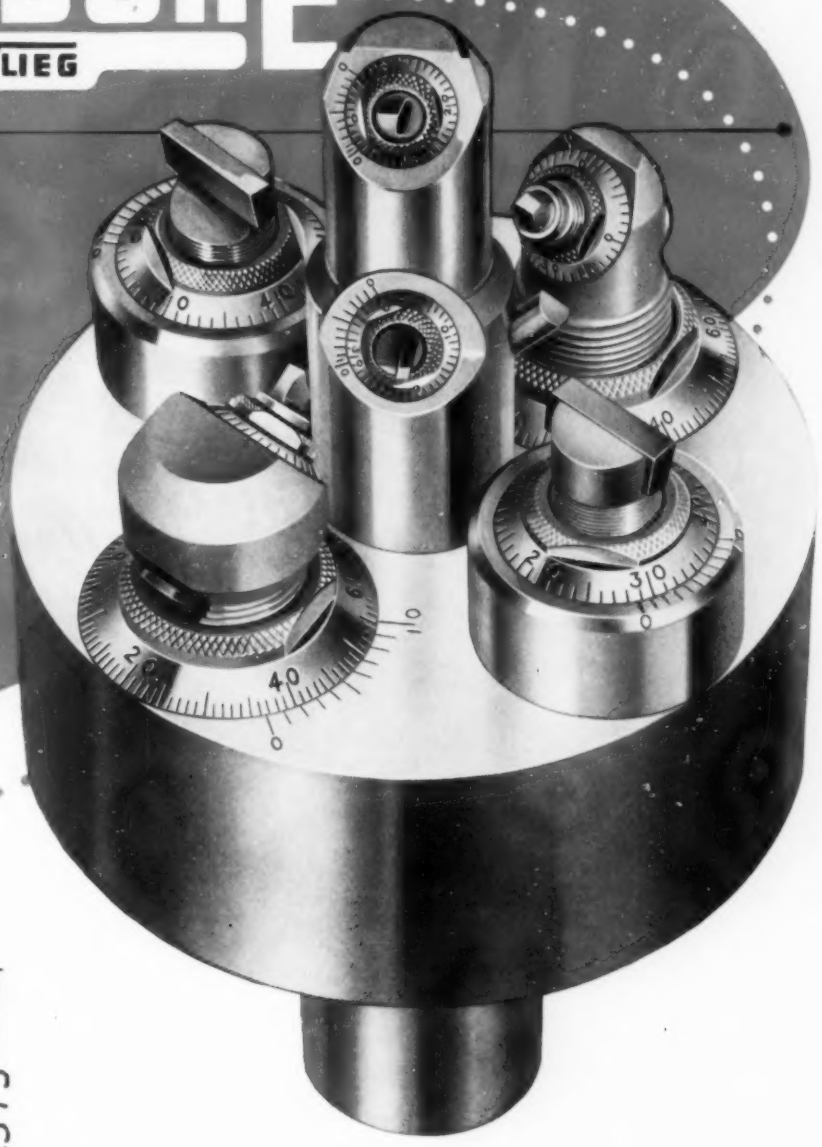
PATENT NOS. 2,330,682
2,537,517

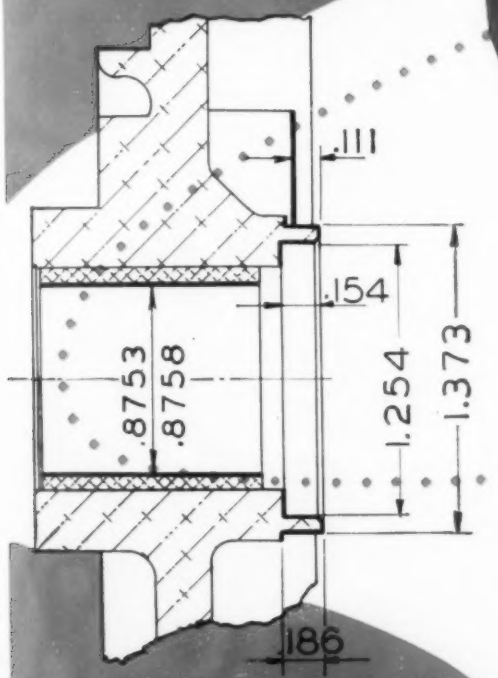
. . . THE

Multi-purpose single point adjustable tool

for

PRODUCTION BORING, TURNING and FACING OPERATIONS.





SURFACES MACHINED ARE INDICATED BY HEAVY LINES

Illustration shows typical example of cluster tooling using standard Microbore units for machining eight surfaces in a magneto plate at one pass. Each tool is independently adjusted by proven micrometer vernier principle and precise limits of accuracy are maintained on production runs.

DE VLIEG MICROBORE COMPANY

2720 West Fourteen Mile Rd. • Royal Oak, Michigan

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• PERFORMANCE

• COST

• APPEARANCE

Ball Bearings are Important Components of Most Mechanical Products

In product design there are three major considerations—COST, PERFORMANCE and APPEARANCE. The proper design combination of these with respect to every component, determines the success of the product, mechanically and commercially. *Ball Bearings are important components of most mechanical products.*

NICE BALL BEARING COMPANY produces complete lines of precision, semi-precision and unground standard and special bearings. Hence, NICE offers the Product Designer the advantage of a diversified product and experience . . . and NICE engineers are well qualified to select or design the economic and mechanically correct bearing answers to application problems.

HAVE YOU ANY BEARING PROBLEMS ON WHICH NICE CAN BE OF HELP?

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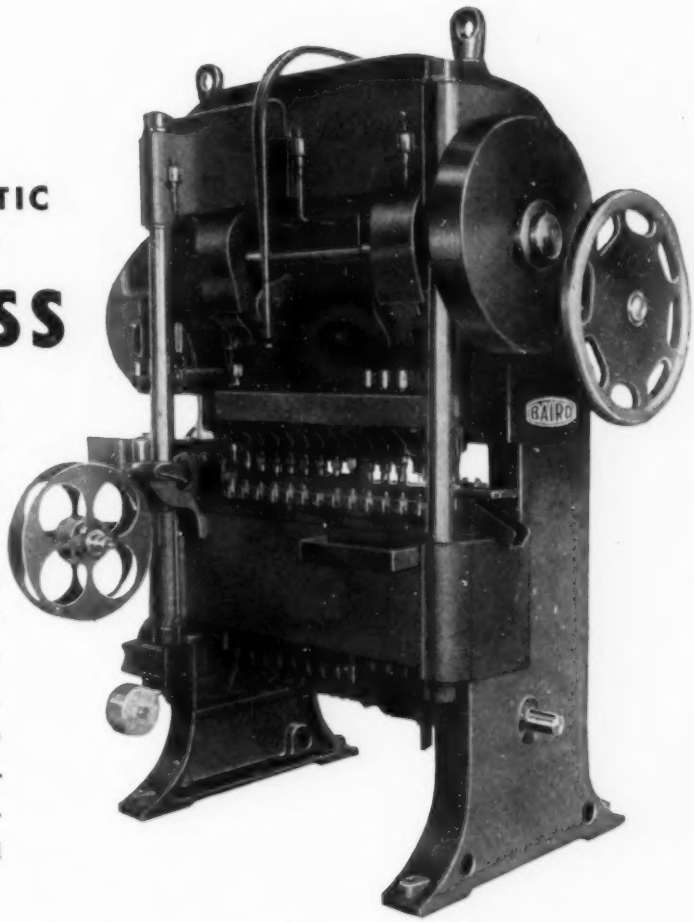
. . . IF IT'S A HIGH PRODUCTION PROBLEM . . .

ASK BAIRD ABOUT IT

A COMPLETED PRODUCT AT EVERY TICK OF YOUR WATCH . . . OR *FASTER*

with the

BAIRD AUTOMATIC *MULTIPLE* TRANSFER PRESS



Production of 3000 to 5000 accurately formed metal parts per hour is normal for this completely automatic Baird Transfer Press . . . even though 10 to 14 operations are included in a single cycle.

The machine shown is one of 12 standard sizes that have rated working pressures from 5 to 55 tons. Coiled stock from 2½" to 4" in width is automatically fed and blanks cut therefrom. Then, human-like fingers grip and transfer the blank to successive die stations for drawing, piercing, embossing, slitting, trimming, sizing, hexing, forming, etc. At each stroke of the machine, a finished piece is automatically ejected.

Tooling possibilities are practically limitless . . . with provision for stamping the widest variety of parts . . . for thousands of different uses. Here indeed is high production with lowest unit costs.

For a most favorable competitive position in today's markets, install a Baird Multiple Transfer Press. "Ask Baird about it." Write Dept. TE

THE BAIRD MACHINE COMPANY
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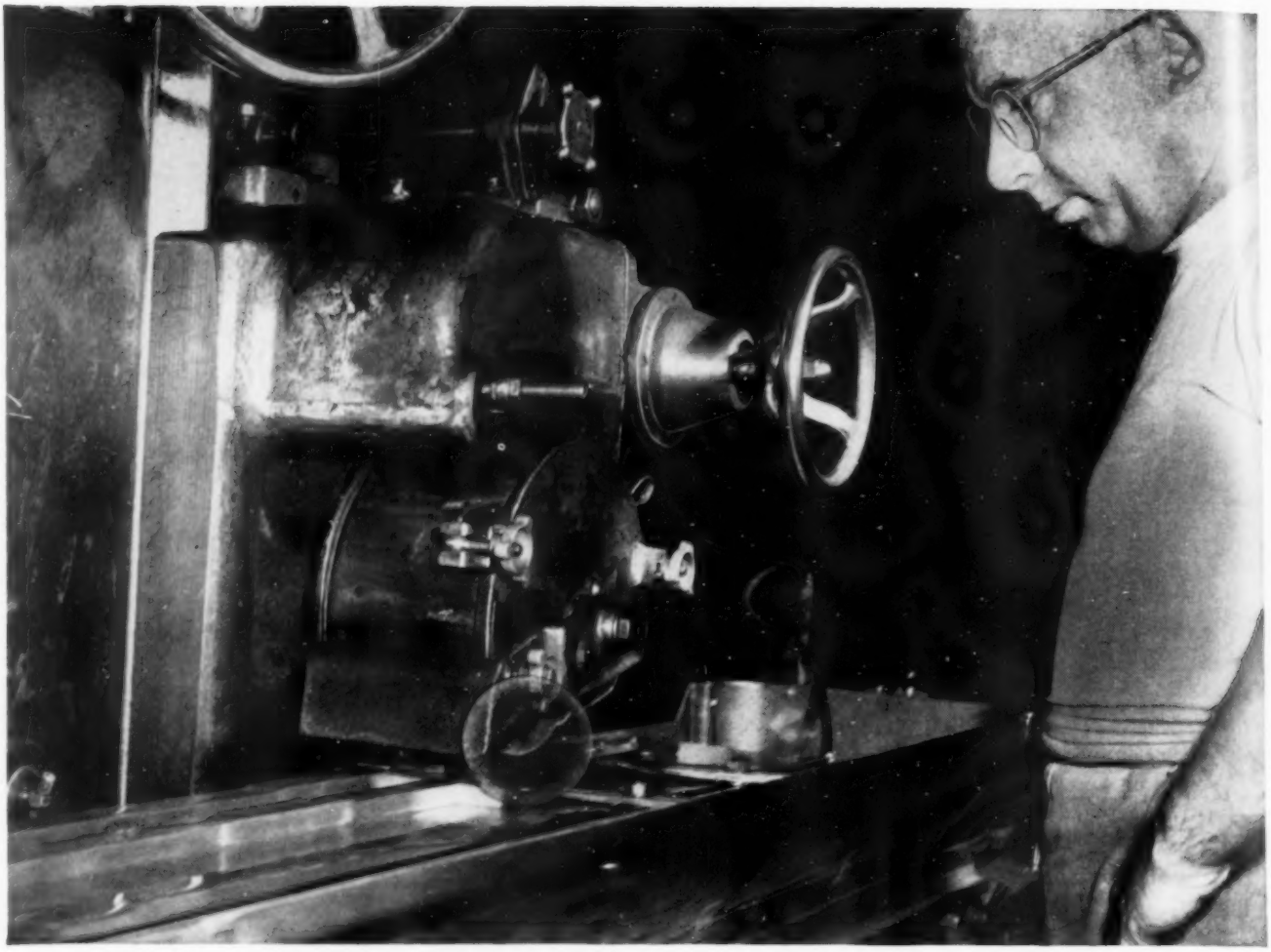
WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

4BA55



"Competitive wheels have never equalled G Bond wheels on our jobs." This Massachusetts tool manufacturer further reports he considers G Bond wheels as maximum load production wheels, besides being extremely free cutting, requiring very little dressing and giving very long life. His requirements are precision grinding hard steel to a very high finish, and to parallel tolerances of .0001". The machine is a Norton 10" Hydraulic Surface Grinder.

Better surface grinding for you... G BOND users' reports prove it!

Top speed, new economy among many "TOUCH of GOLD" *advantages listed*

Reports from surface grinding customers on the performance of G Bond wheels sound pretty much alike. That's logical, because each customer is getting exactly the advantages he's looking for — *freer, cooler, faster cutting action . . . heavier cuts without burning . . . closer tolerances and smoother finishes . . . easier dressing and more pieces per dressing... more work, and more kinds of work, per wheel.*

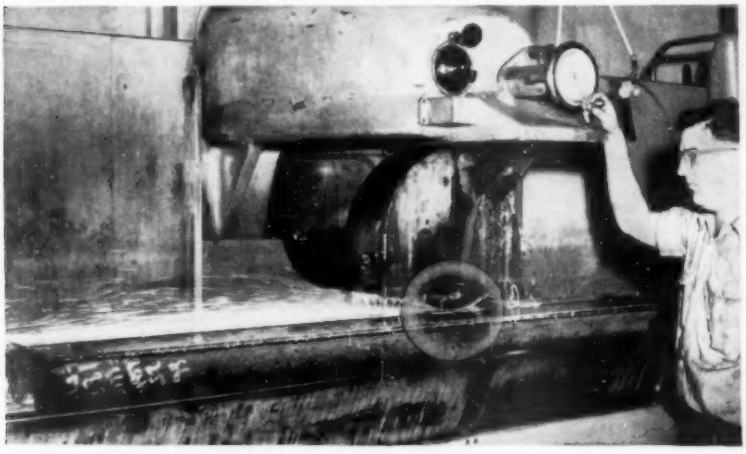
Your Own Surface Grinding

will benefit by the G Bond's unique ability to hold each abrasive grain just long enough for maximum cutting action — an important "Touch of Gold" advantage that means time and money saved, plus better product quality, throughout the range of precision and semi-precision grinding jobs.

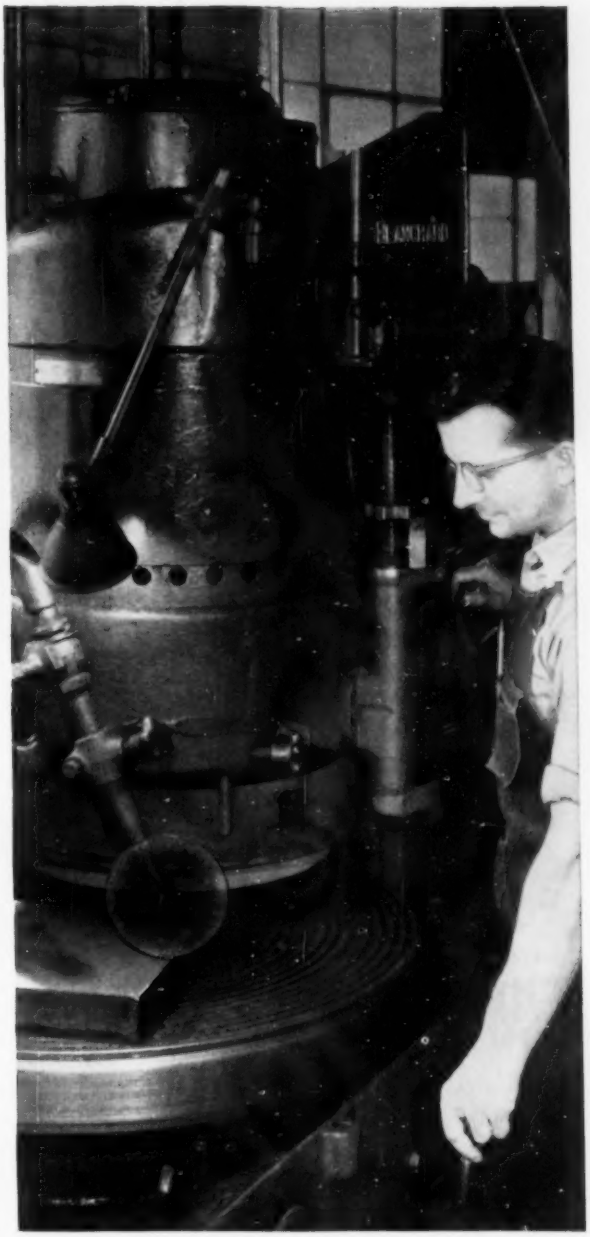
See Your Norton Distributor

for the G Bond wheels, cylinders and segments you need. They're available in a variety of famous Norton abrasives. Of these, 32 ALUNDUM* abrasive is particularly suited for fast stock removal and heavy feeds — it grinds exceptionally cool and fast, with minimum dressing. And remember: only Norton offers you such long experience in both grinding wheels and grinding machines to help you produce more at lower cost. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

Grinding precision spur gears of SAE 8620 steel, hardened to 59-63 Rockwell C, this Maryland pump and motor builder thoroughly tested G Bond wheels against other makes. He reports that G Bond wheels cut cooler, hold form much better, last 50% longer due to less frequent dressing, and are easier on diamonds.



"Norton G Bond wheels are faster and freer cutting, need less dressing than any other wheels we've used," says this Pennsylvania metal working company. Material ground is boiler plate and miscellaneous steel plate. Stock removal rate is 4.5 to 6 cubic inches per minute.



Jigs, fixtures and other parts of miscellaneous steels, besides some of cast iron, are the jobs on which G Bond segments are used by this Ohio tool and gage maker. He credits the G Bond segments with giving a better finish, with less dressing, than any he previously used.

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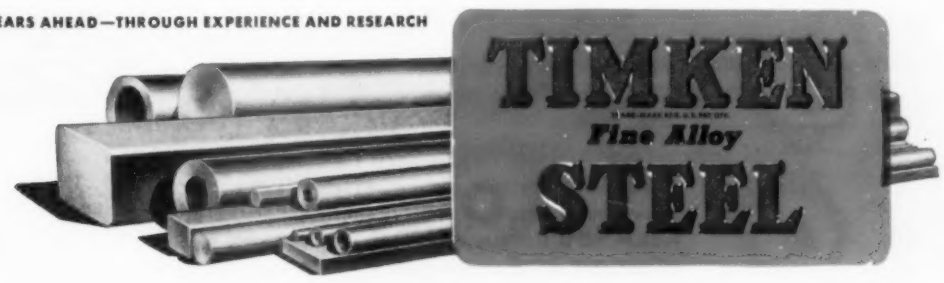

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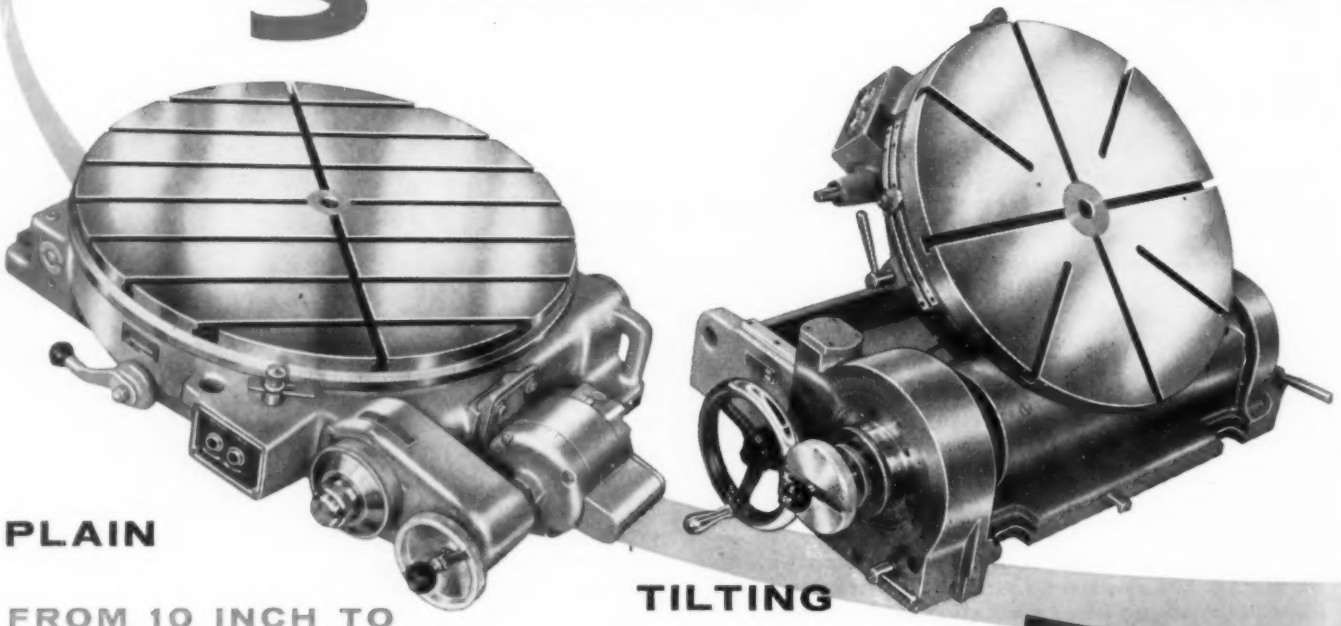

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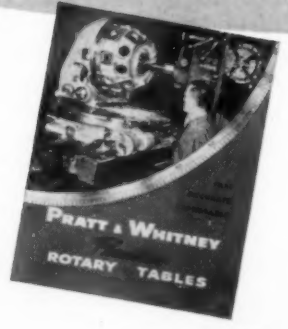

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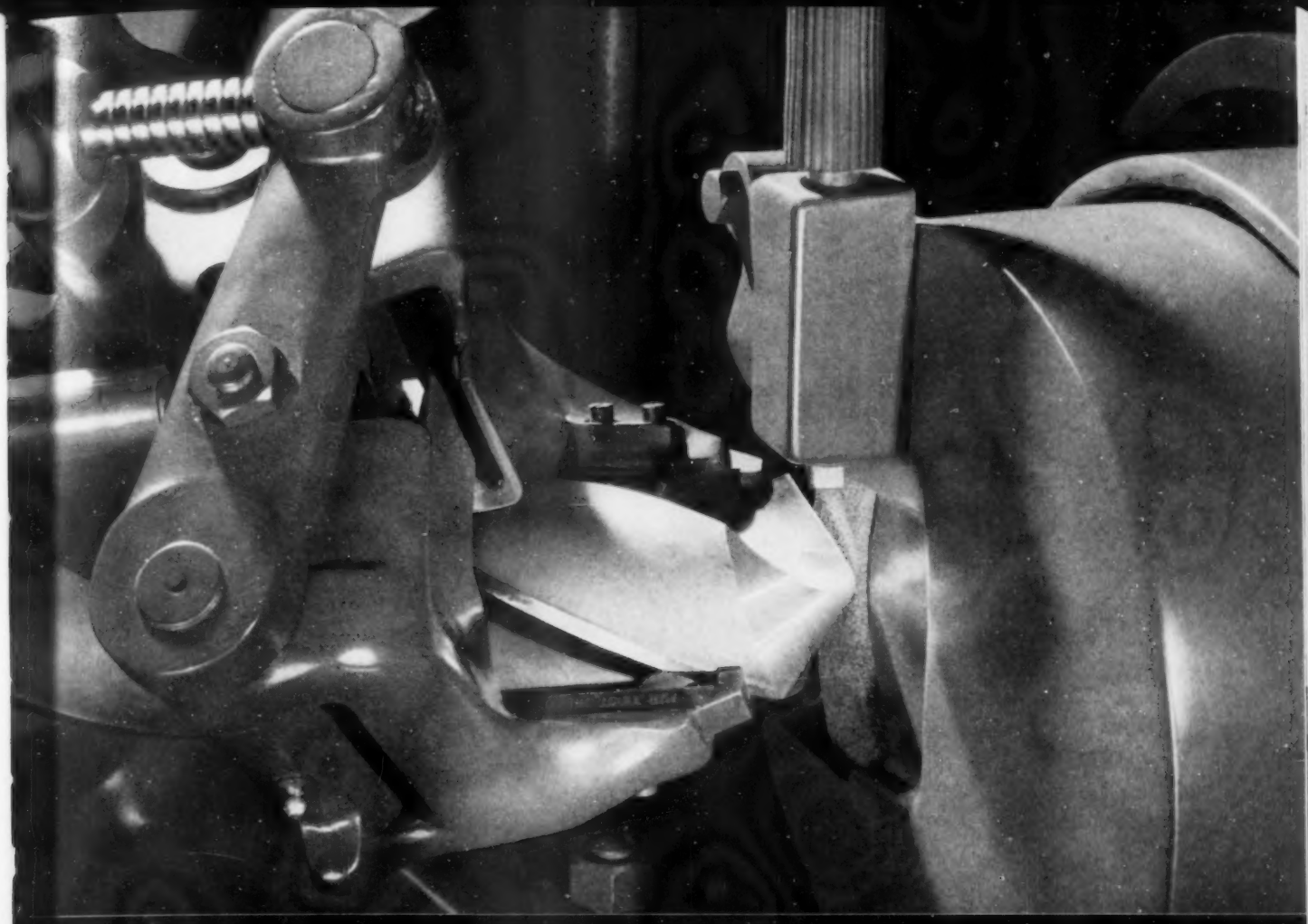

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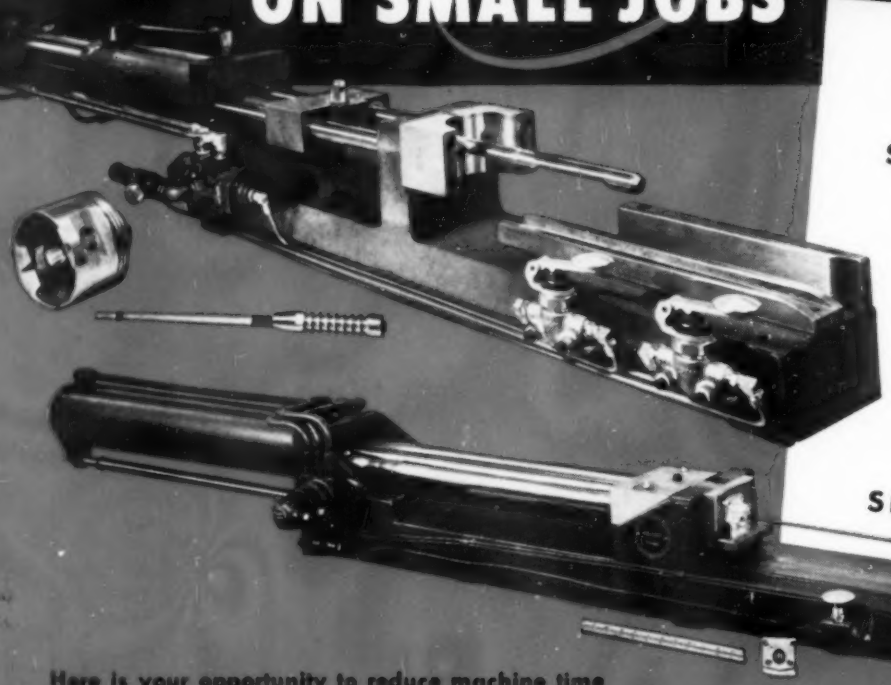

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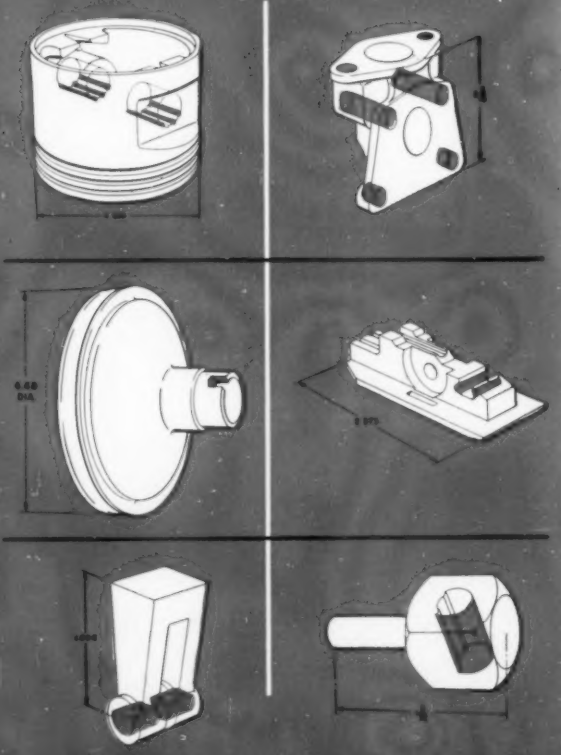

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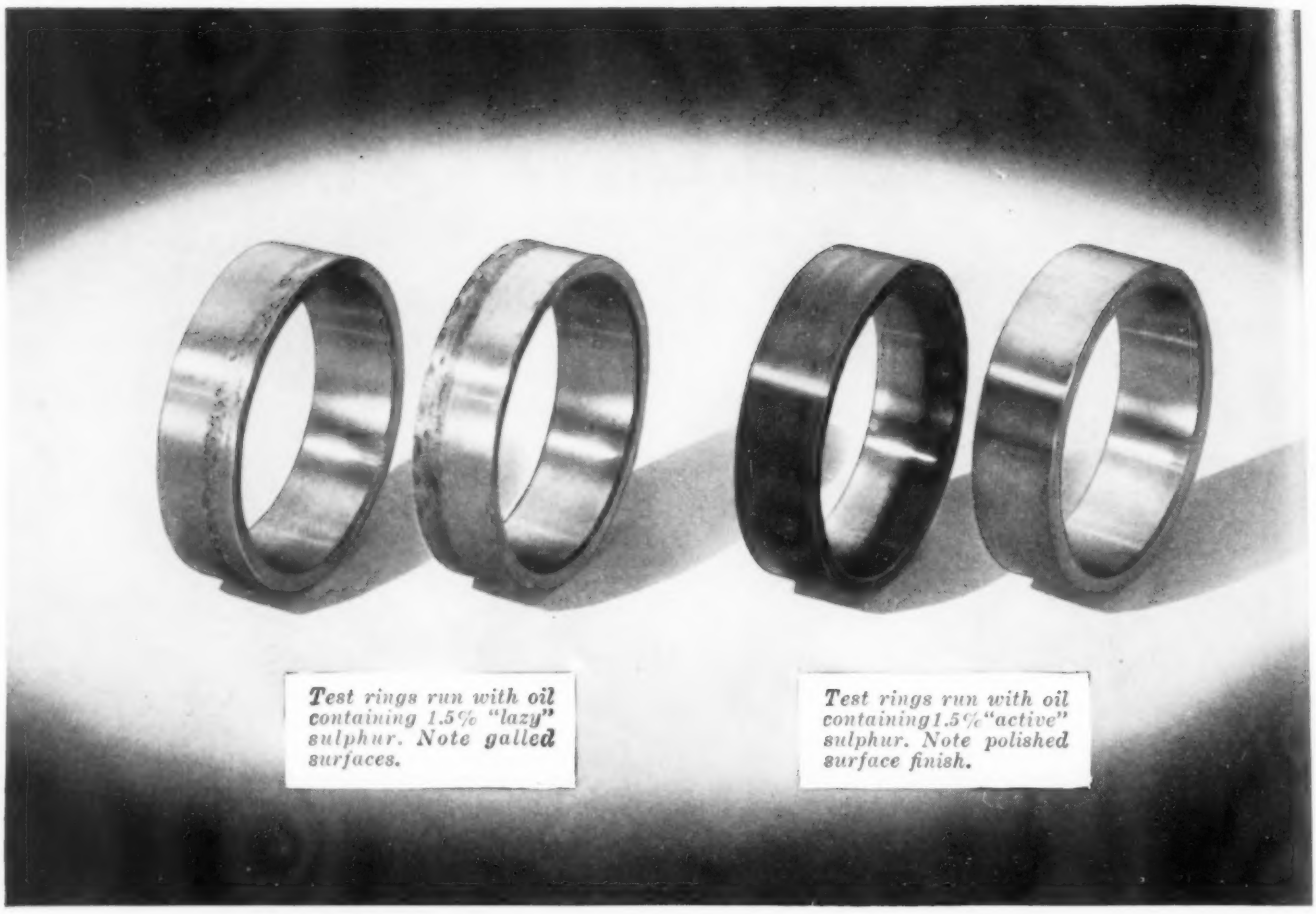

Test rings run with oil containing 1.5% "lazy" sulphur. Note galled surfaces.

Test rings run with oil containing 1.5% "active" sulphur. Note polished surface finish.

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This comparative test proves it! Both tests were run on an SAE Lubricant Tester using two oils with the same percentage of sulphur. The specifications were similar—but look at the results!

The set of rings on the left were run with an oil containing "lazy" sulphur that did not provide the necessary anti-weld qualities. Under the heavy loads present in the test, the rings quickly galled and seized. The pair on the right were run with an oil containing "active" sulphur, the *only* type of sulphur that will prevent galling or seizure. It is performance that counts, not specifications.

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The Tool Engineer

Wanted—Engineers

How often have you seen these words in the Help Wanted section of the newspapers or trade press? How many times have you read or heard about the engineering shortage in this country? What have you done about it—as an individual—as a member of a technical society—as an employee—as an employer—or even as a member of your community? Probably very little. However, you can do something if you will but try.

More of the youth of our nation must be encouraged to plan for a future in engineering. We can all help toward this goal by active participation in the vocational guidance programs of our school systems and our technical societies councils. The story we have to tell concerns not only the need for engineers to maintain the high standard of living we all enjoy from the day we are born, but something more vital. Labor is enjoying fewer working hours, increased wages and many more things which result in higher manufacturing costs, and yet they and most others expect no increase in the selling price of the articles they produce. It is the engineering profession that is called upon to develop new techniques and better processing methods to make such a situation tenable. Despite this increased demand there are fewer engineers available.

If it is figures you want, we graduated over 50,000 engineers in 1950 but this fell to 20,000 in 1954. For what it is worth, note also that during the same period Russia's engineering graduates increased from 30,000 to 55,000.

So let us also sell our youth on the responsibility they have to all Americans to plan to fill the needs of the engineering profession by deciding on a career in engineering.

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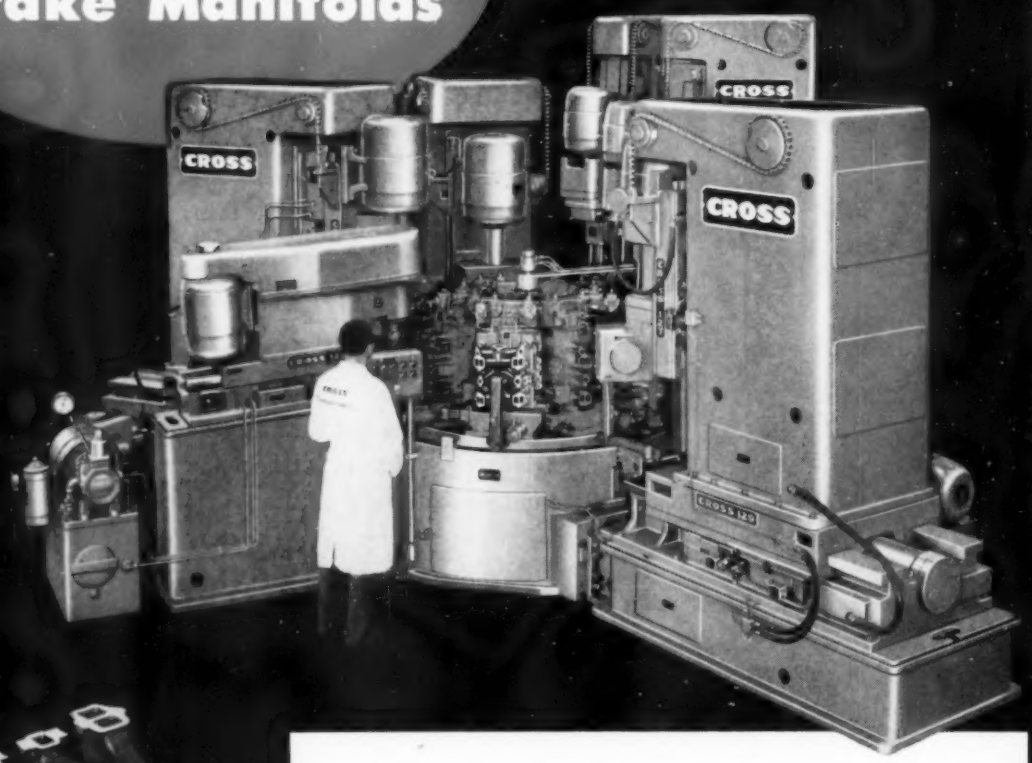

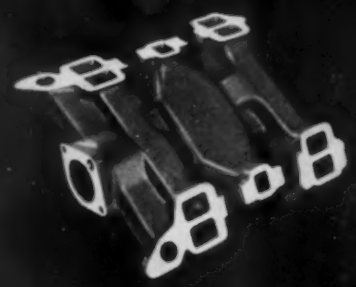

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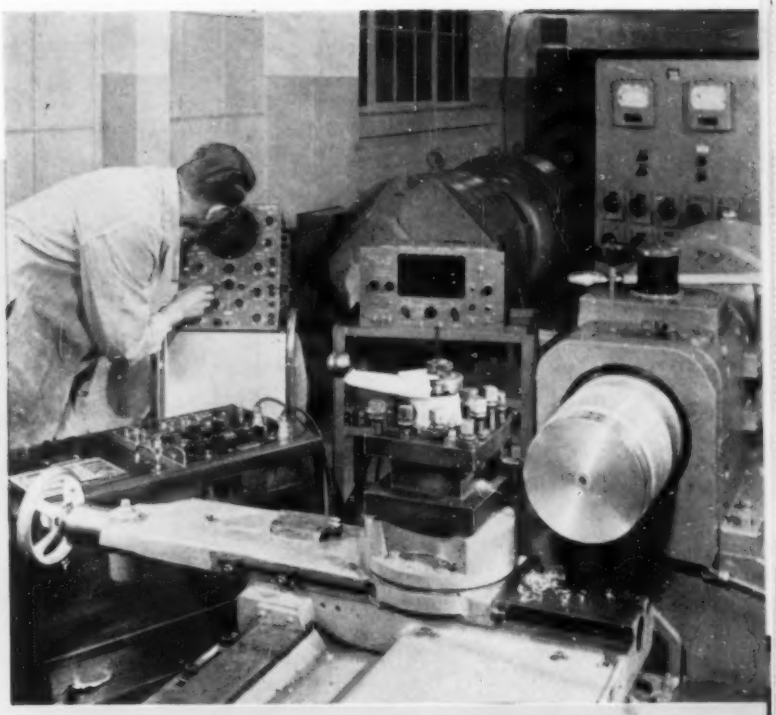

Fig. 1. Student in machinability course is studying components of forces in a single-point tool by recording measurements with an oscilloscope and other instruments attached to a two-component dynamometer.

By Robert E. McKee*

Associate Prof. Production Engineering
University of Michigan,
Ann Arbor, Mich.

MASS PRODUCTION, as a result of tool engineering, is a part of the American way of life and this country is its home. Wherever there is a part to be manufactured there must be engineering—for research, development, design, production, construction, operation, maintenance, application, sales and management.

The lives of all people are affected by the abilities of producers to provide more goods with less human effort and to thereby improve the standard of living. In this country, engineering has contributed generously to peacetime and defense economies. Tool engineering has played an important role in establishing our high standard of living.

A logical question, sometimes missed by the college educator or the curious student, asks: "What training is required for tool engineering?" The response to this question, based on absence of proper information, can be completely misleading.

Based on early concepts of this type of activity, training was formerly obtained by practice and self study. Essentially, tool or production personnel were trained through apprenticeship and attainment of skill on the job. Many learned the skills from their forefathers and pursued the same type of vocational pattern for their entire life cycle.

Tooling and production knowledge has advanced along with the improvement in the design of machines, methods, processes, tools, materials and quality inspection. Today the proper foundation for a tool or production engineering career lies in an engineering education in an accredited engineering school, *Figs.* 1 and 2. However, this subtracts no credit from the record of the practical tool engineer.

Tool or production engineers in modern industrial plants work with production personnel, materials, processes and machines. They are responsible for the development, design, supervision and construction of the tools of production. In this modern sense cutting tools represent only a part of this significant field. Special gaging equipment, jigs, fixtures, dies, single point tools, multiple point tools, multiple tooling, progressive tooling,

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***Senior member ASTE Ann Arbor chapter.**
Abstracted from a paper presented at the annual Engineer's Day, University of Mississippi.

combined tooling, assembly line production methods, special machinery for improved production, materials, material handling, machines, plant layout, and machinability are other responsibilities of the present-day production engineer. Coupled with these increased responsibilities are added complexities of pneumatic, hydraulic, mechanical and electrical equipment used in modern production lines.

For instance, the term automation has been used in connection with some of the changes taking place in present production practices. Production employees who operate "pushbutton" type of machines need relatively little skill or technical training unless industry requires tool-setting and performance know-how for this class of work. Yet design, construction and maintenance of automated lines will require engineers and technicians who understand the elaborate control systems and functions of the modern plants of production. While many semi-skilled jobs are being altered by modern mechanization, tool engineering is changing even more rapidly and radically.

Tool or Production Engineering Curriculum

Processes and materials
Machine tools
Structure of metals
Metal forming
Production machines
Parts processing
Measuring and gaging
Machinability
Process instrumentation
Tool design
Jigs and fixturing
Machine tool design

Under processes and equipment, the emphasis is placed on a reduction in physical labor by the substitution of mechanical equipment. The modern ditchdigger is a machine, operated by a skilled man, that will outproduce the efforts of many unskilled laborers. Huge presses may be equipped with automatic loading and unloading systems to handle the largest stamping on an automobile body, *Fig.* 3, increasing plant safety and reducing physical effort involved. Some machines are now controlled with punched tape and electronic devices to machine and automatically inspect the component part.

Many new materials and new uses for existing materials are constantly being developed for consumer goods. Specifically, high temperature alloys, high-strength materials, new types of cast irons, titanium, plastic resins, and new types of cutting tools are involved in some of the current production problems. As an example, some materials that were originally considered to be in the cutting tool category must now be machined and they present many obstructions to efficient machining with available equipment and methods.

From the standpoint of economics, cost-consciousness is constantly requiring more engineering effort in producing the maximum pieces per hour at the minimum cost. The automatic production line requires a huge capital expenditure. The cost of capital invested per employee has mounted constantly. Comparable dollar figures indicate $12,000 invested per employee today as compared to $6,000 several years ago, and the investment is still growing at an increasing rate, *Fig.* 4. High labor costs contribute directly to the attractiveness of automated production lines.

Competition in production has been a key word to stimulate American enterprise, ingenuity and economy. An example of the result is the production attainment of the automotive industries. At times, other than those of defense spending, competition in American industry has set a pace unequalled in any other country in the world. This emphasis on production and the tools of production

Professor Robert E. McKee, chairman of the ASTE National Education Committee, has demonstrated a vital personal interest in the future course of engineering education. Since 1943 he has been associated with the University of Michigan, where, in addition to teaching production engineering courses, he has had an active role in that institution's outstanding machinability research program. This thought-provoking article is presented to stimulate interest in and discussion of the important subject of engineering training.

Fig. 2. (left) Study of various types of measuring equipment used in inspection practices in connection with a course in dimensional quality control.

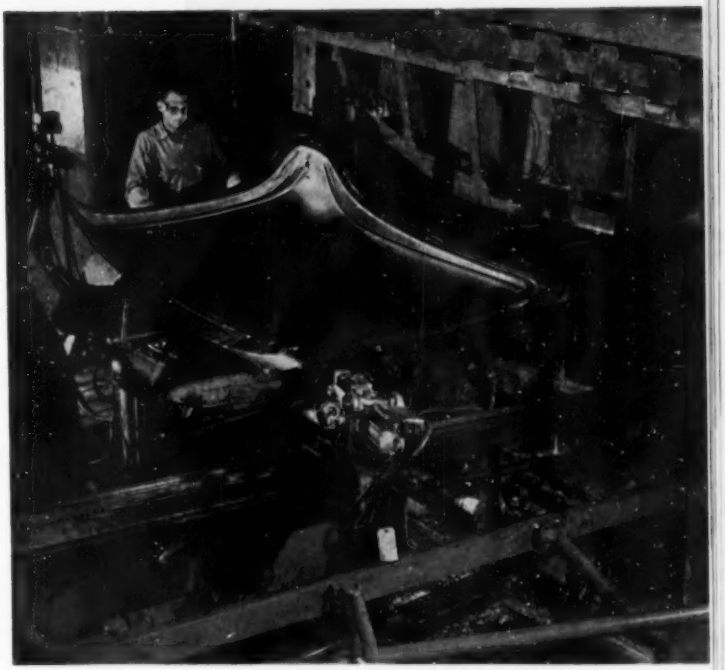
Fig. 3. (below) Mechanized handling of large automotive stampings is typical of production processing trends.

underlines increasing demands for more and better qualified tool engineers.

With this understanding of the needs for tool and production engineering and present developments in the manufacturing field, what are some of the requirements of training for the production or tool engineer of tomorrow?

A recent survey showed that 36 accredited engineering schools in the United States give from 25 to 75 semester hours of credit in tool engineering type of courses. The average of these schools is 37 semester hours. There are 34 schools of 1500 or more engineering enrollment that offer 9 to 75 semester hours credit in this field with an average of 28 semester hours for the group. A total number of 148 schools are included in the survey and some of these offer little or no work of this type.

Some of the tool engineering courses offered are designed as a service function to mechanical, industrial, aeronautical or metallurgical engineering. Indeed, the term engineering shop practice has sometimes been associated with providing the prospective engineer with an opportunity to learn the proper use of a hammer, monkey wrench, screwdriver and chisel, with little or no attention given one of the most important aspects of modern civilization in war or peace—that is production. Yet it is increasingly apparent that production and tooling for manufacturing processes require the services of men trained in the science of metal-cutting and the application of mechanics, electronics, hydraulics and pneumatics to the machines that produce our consumer goods. Furthermore, since a large percentage of such engineers are engaged in small-plant manufacture, they are restricted in any type of in-plant training facility. Unfortunately, the responsibility for production engineering training has in most cases been shrugged off by the educator and developed by industry as a necessity rather than a desire.



—Photo courtesy Ford Motor Co.

There is a continuous conflict in thought between the proponents of general versus specialized training at the university level. According to an editorial appearing in a national engineering periodical, "If in the U.S.A., engineering is to be greatly subordinated or eliminated in favor of the teaching of liberal arts and the humanities, who will there be to carry on our technical know-how, run our great industrial plants, provide the goods and services that have made the U.S.A. the envy of the world?" In the same issue was another interesting statement to this effect: "There can be no doubt

that the engineering college graduate—survivor of a tough, exacting discipline, in which about one-half survive—is well prepared for the real, personal and intellectual growth which men of culture experience in the exciting years of maturation."

An examination of a typical mechanical engineering curriculum shows why the student develops in reasoning ability, in the use of basic mathematics and science and in the use of tools of oral and written expression as well as tools for recording ideas. Such a curriculum appears in the accompanying table entitled, Mechanical Engineering Curriculum.

For those students who are directly interested in the application of engineering to production processes, other courses might be offered during the third and fourth years such as indicated in the table, Tool or Production Engineering Curriculum. The emphasis would be placed on production processes instead of advanced heat, power and design but close parallelism is evident in courses up to the latter.

Since the primary functions of the tool engineer

Mechanical Engineering Curriculum

First year:

- Basic mathematics (preparation for calculus)
- English and speech
- Orientation in engineering
- Engineering drafting
- Engineering materials

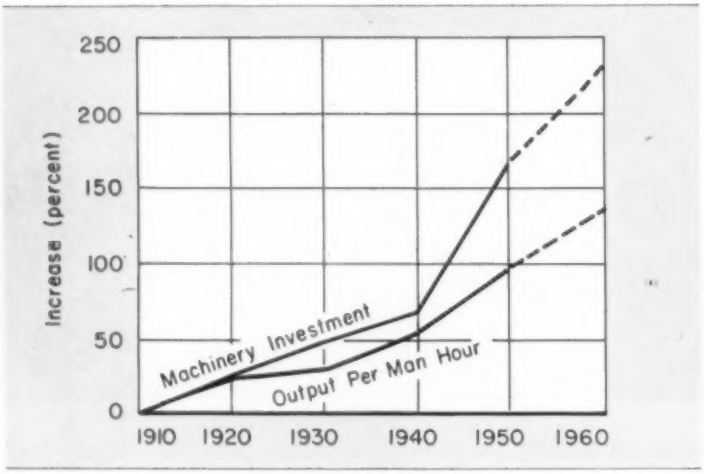
Second year:

- Basic sciences (calculus and physics)
- Basic engineering sciences (statics, kinetics, dynamics, mechanisms and strength of materials)
- Introduction to engineering economics

Third and fourth years—advanced courses in:

- Engineering science
- Engineering administration
- Industrial organization and management
- Manufacturing equipment and controls
- Heat power
- Machine design
- Machine tool design

Fig. 4. Rate of growth of investment for machinery compared with output per man-hour has been projected into future (dotted line), indicating even faster increase in complicated production equipment to be anticipated. Chart is based on data supplied by U. S. Departments of Labor, Commerce and Bureau of Labor Statistics.



are analysis, planning and execution, analytical thinking and judgment are necessary. This is especially true when production methods, the means of production and operational sequences, are being considered along with volume, rate and economy of production for a particular product design. Planning requires of the tool engineer the ability to visualize in correct perspective the whole of a production problem and to be able to prepare an orderly tooling procedure. Planning also necessitates technical writing and recommendations for the means of production. Execution means possible changes in design, preparation, specifications, purchasing, organizing and supervising of operational procedures. In such a capacity, the tool or production engineer must frequently function as the liaison engineer between design and production. He is sometimes required to hire personnel, to complete time studies, to provide cost analyses as well as plan operational sequences and production procedures. He is responsibile for purchasing and for the investment of large sums of money in tooling, machinery, production and plant facilities.

Consequently, industry cannot directly give most present engineering graduates responsibilities associated with production processes until they have completed an apprenticeship program after graduation. Particularly, this applies where schools and universities offer little or no work of the type that is required in production engineering.

According to a survey (1946) by the U. S. Department of Labor, it was shown that 67.6 percent of all mechanical engineers were employed in a manufacturing activity. In this same survey, it was shown that 36.7 percent of the electrical engineers were employed directly in manufacturing. However, if these percentages were reduced by the number of those working directly on machine and tool design problems, it is evident that there would be a substantial percentage remaining of those working with production processes.

It would seem an entirely valid conclusion, therefore, on the basis of such statistics that there is sufficient need in this line of work for the inclusion of tool and production engineering type courses in more of the engineering curricula of universities and colleges.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Progressive Riveting Die

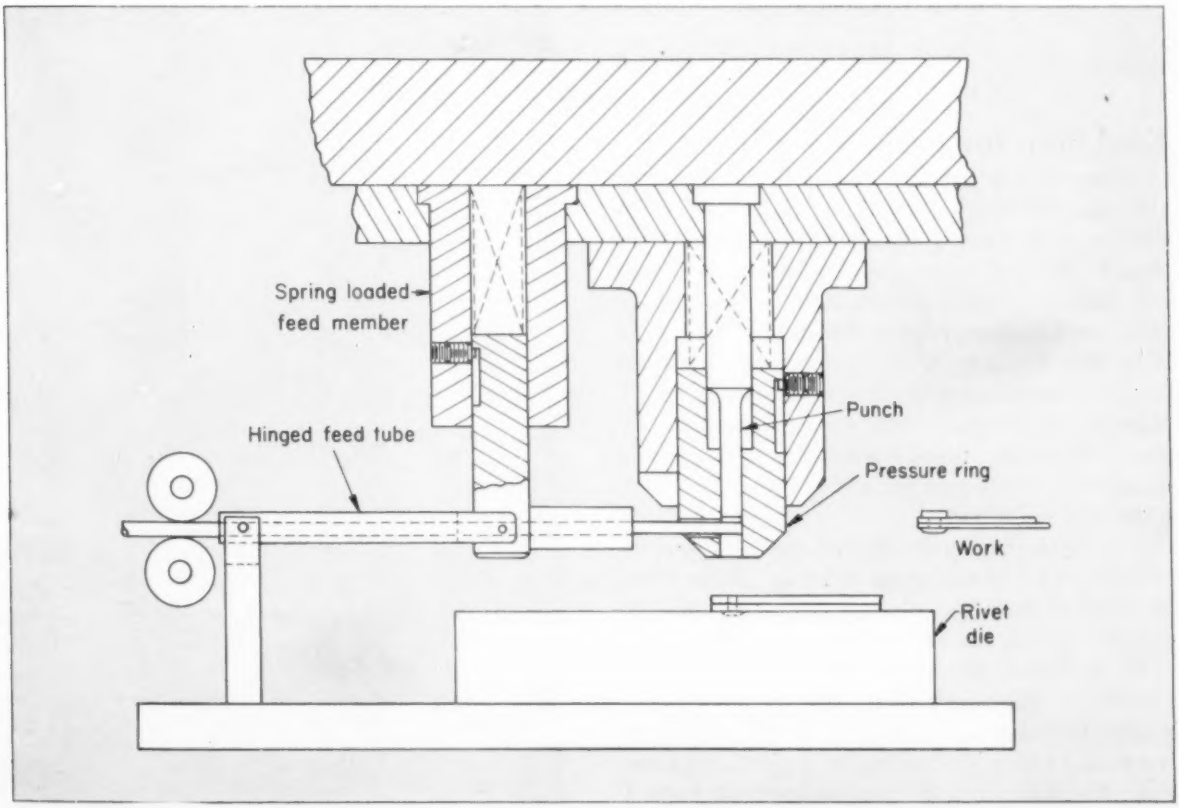
New tooling for increased production of a stamped and riveted assembly was designed to cut costs. Now, instead of two dies to stamp out the two parts, one progressive die stamps both. Also an extra station was incorporated in the die to assemble the parts, thus avoiding a subsequent operation. This station, illustrated, is unusual in that it both makes a rivet and fastens the two parts together.

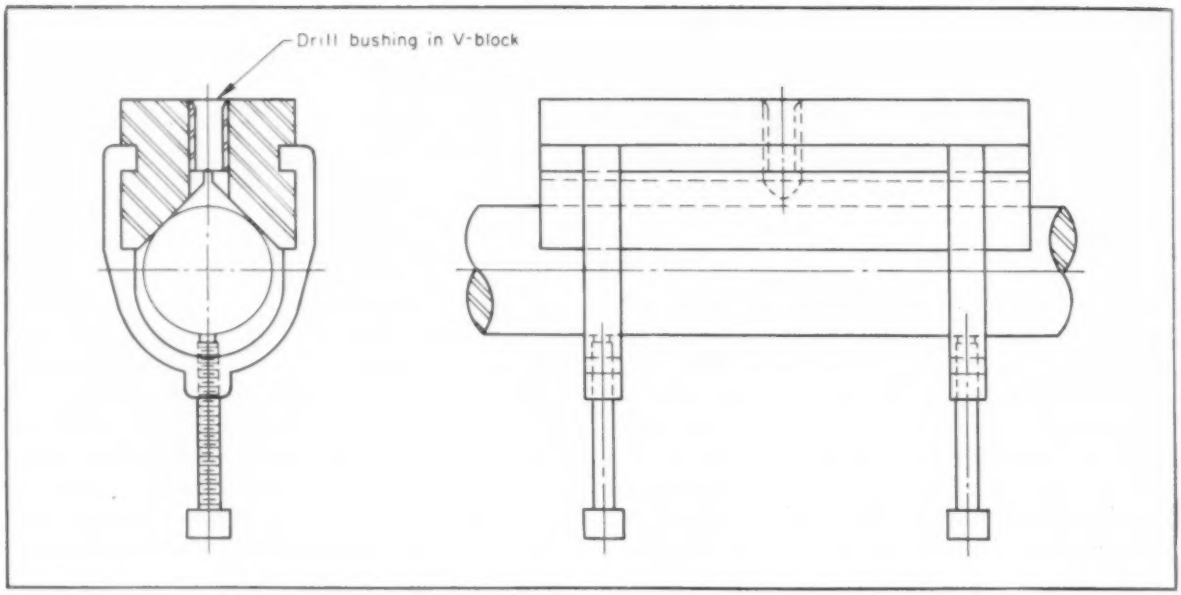
Copper wire is fed into the die by continuously rotating rollers driven by a small geared-head motor. Of course, other methods of feeding could be employed. The wire feeds in through a hinged tube. The discharge end of the tube is joined to a spring-loaded member on the punch holder. This member moves with the pressure ring which surrounds the punch. The copper wire, feeding through the tube, enters a hole in the side of the pressure ring.

When the press is tripped the pressure ring descends and holds the workpieces together. As the ram continues to descend, the punch which rides inside the pressure ring shears a slug off the end of the wire. The punch then forces this copper through holes in the workpieces. These rivet holes were pierced in a previous station. A cavity in the die section forms one end of the rivet while the head is formed by the punch inside the pressure ring. As the ram rises, the wire feeds forward for the next stroke.

The punch must be ground to a good sliding fit inside the pressure ring to prevent flash appearing at the edge of the rivet head. The punch and die cavity must, of course, be larger in diameter than the holes in the workpieces in order to form heads on the rivet. This die with the riveting station resulted in a tremendous reduction in production time required to make the assembly.

Henry Koslow
Bronx, N. Y.





Center Drilling Shafts

To accurately position holes normal to the centerlines of shafts, the device illustrated has been found particularly useful. It is especially valuable as a time-saver when such holes must be made with a hand drill. This would be true, for instance, when a shaft is part of an assembly and to drill it on a drill press would necessitate disassembly. Again, the shaft to be drilled may be difficult to handle on a drill press.

A standard V-block made of cast iron or machinable steel may be converted to such a centering device merely by machining a bushing hole central with the V. This does not impair the V-block for conventional use. Slip bushings may be used if a variety of sizes of holes are to be drilled.

W. H. Saling
North Texas Chapter

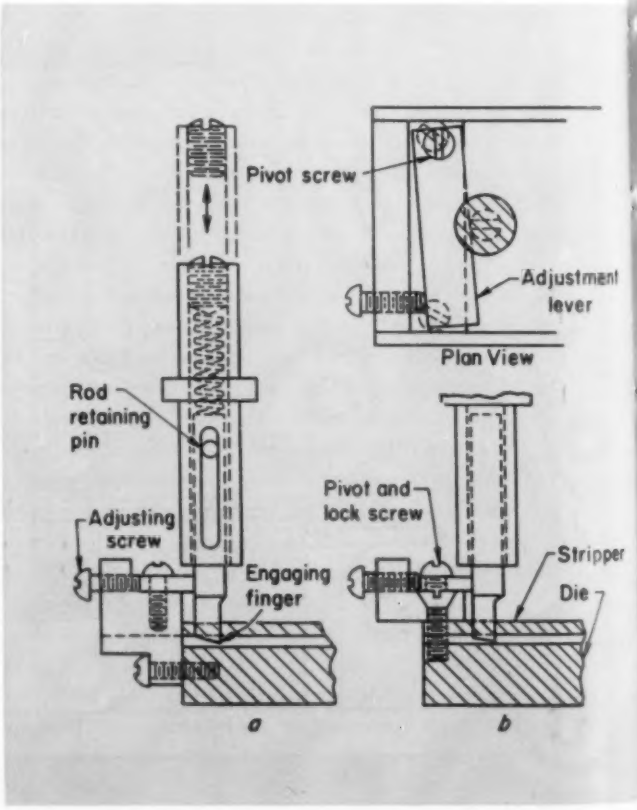
Feed Stop for Progressive Dies

When work is punched from a strip in progressive operations, close accuracy of feed is often difficult with ratchet operated feed rolls. Even though the tool is precisely constructed, uneven roll feeding, stretch of soft stock in blanking or other conditions may cause difficulties.

In this situation it is necessary to introduce means for positioning the strip at an exact spot, by blocking its advance with some of stop. Pilot plungers entering special holes in the stock or pilots upon ends of plungers are not always satisfactory when used on thin stock.

The simple finger stop described, offers a practical means for obviating the difficulty. It can often be attached to a tool which has given trouble in service. Also it can be used for thin stock.

As illustrated, the design basically consists of a plunger in the punch pad. The plunger carries within itself a short sliding rod or finger, which is retained within the plunger by a pin through the rod. A slot through the plunger, permits vertical



movement of the rod. A spring within holds the rod extended but allows it to telescope when the plunger descends.

The lower end of the rod is shaped to act as a finger, stopping advance of the stock on the down stroke of the press. Close feed control requires that means be provided for delicate adjustment of this finger. This is secured by a lever, carried on a block and pivoted upon it, at the rear of the tool. This lever is adjusted by a screw which bears against it. It is locked by tightening the pivot screw.

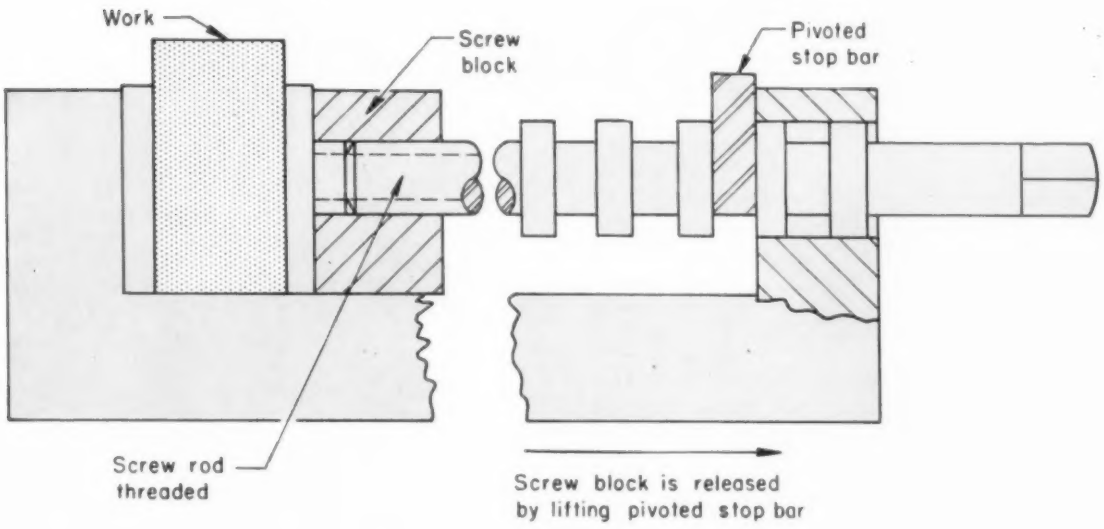
Methods of fastening this block to the die may be varied to fit conditions. The illustration shows two methods. In design *a* it straddles the work strip; design *b* shows it attached to the stripper plate.

The rod must fit quite loosely in the plunger to allow for movement of the finger in making adjustments for control of feed. The finger should be trimmed as accurately as possible at its lower end before resorting to the adjustment of the finger. The finger tip, as well as the sliding parts, should be hardened.

When a tool is designed to use this finger stop, the length of the ratchet feed should be slightly longer than die layout. This will assure a constant push against the finger in operation. When this stop is added to a tool already constructed, an extra tooth added to the ratchet feed will suffice to give desired results if the pressure of the rolls is eased to permit a slight slip.

This method also may be applied to longitudinal push or pull feeding fixtures, which often replace roll feeding.

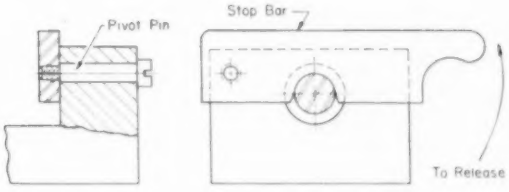
Frank E. Chace
Pawtucket, R. I.



Quick Acting Fixture Screw

When size of work being held is changed frequently, a large capacity screw closing vise or fixture, which is used for both large and small size work, is slow to adjust. The illustrated design for a quickly adjustable screw is both fast in use and simple in construction.

A series of grooves is turned into the shank of the screw rod. A hinged leaf or stop is pivoted from the rear block of the vise. To position the sliding jaw, when work size is changed, the pivoted stop is swung up and out of the groove in the screw rod and the screw rod is moved longitudinally so that the proper groove is positioned to the stop. The stop is then closed down and the screw is cranked up tight in the conventional manner. A standard stripper bolt or shoulder screw makes a good hinge pin.



H. J. Gerber
Member-at-Large
Stillwater, Okla.

Knockout for Forging Dies

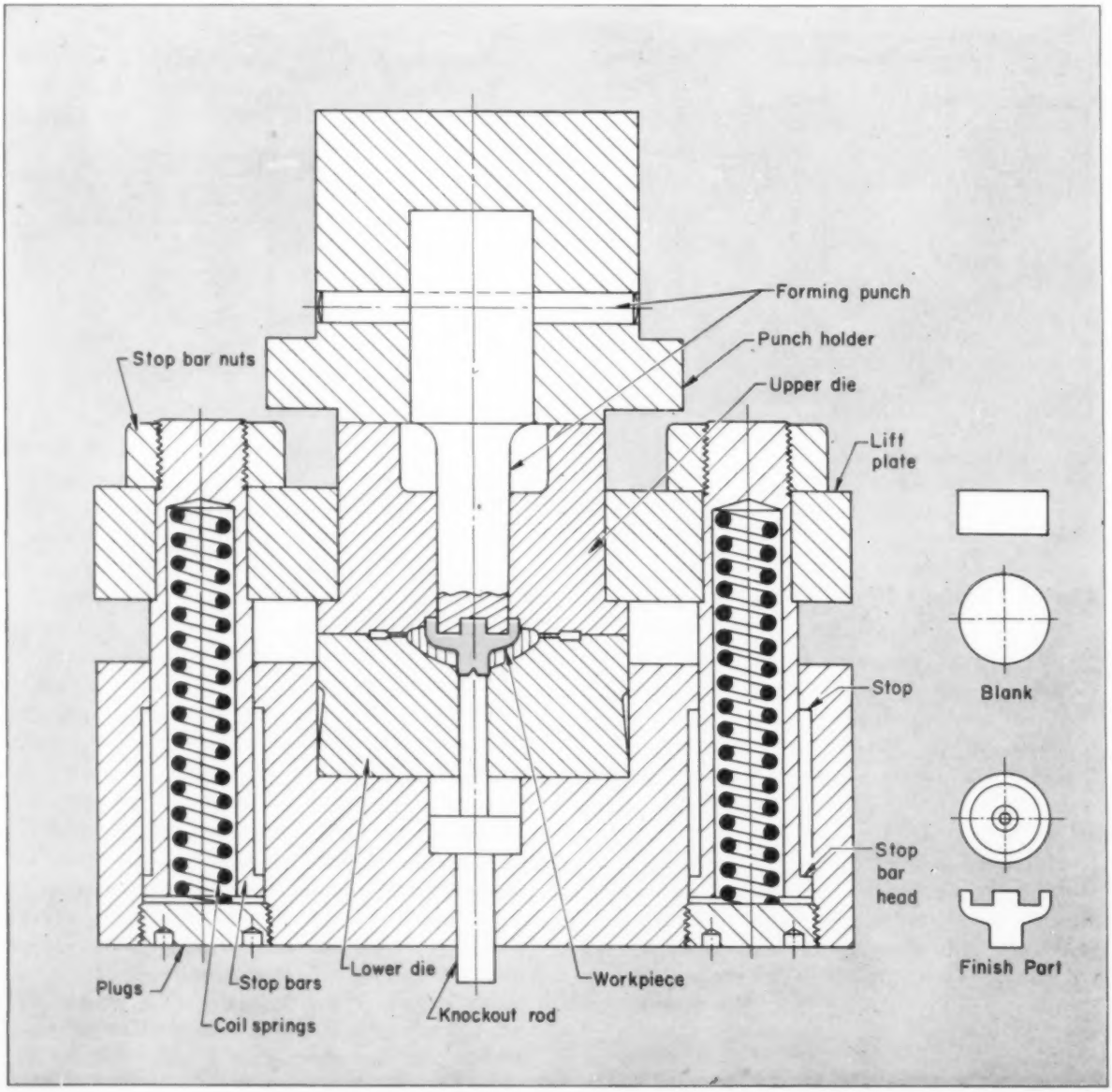
Because of the shape of a workpiece formed in a press forging operation, knockouts or ejectors had to be provided for both the die and the punch. The part itself is a spring loaded safety valve of brass, forged hot.

The die is shown in the closed position in the accompanying illustration. Actually the upper die consists of two elements, the inside forming punch and the surrounding upper die which also serves as an ejector or stripper to strip the part from the punch.

The upper die is fastened to a lift plate containing two spring loaded stop bars. The bars are assembled to the stop plate by removable nuts for easy disassembly.

The punch and upper die, however, are not joined together. The punch is a sliding fit in the upper die and can thus move vertically independently. The coilsprings hold the upper die in a normally open position for insertion of the heated stock. When the press ram ascends after the part is formed, the workpiece is ejected from the lower die by the knockout rod. As the ram continues to ascend it raises the stop bars until the heads of the bars strike the stop surfaces in the die holder. At this point the upper die remains stationary while the forming punch continues upwards, stripping it from the part.

Hjalmar Dahl
Upplands Vasby, Sweden



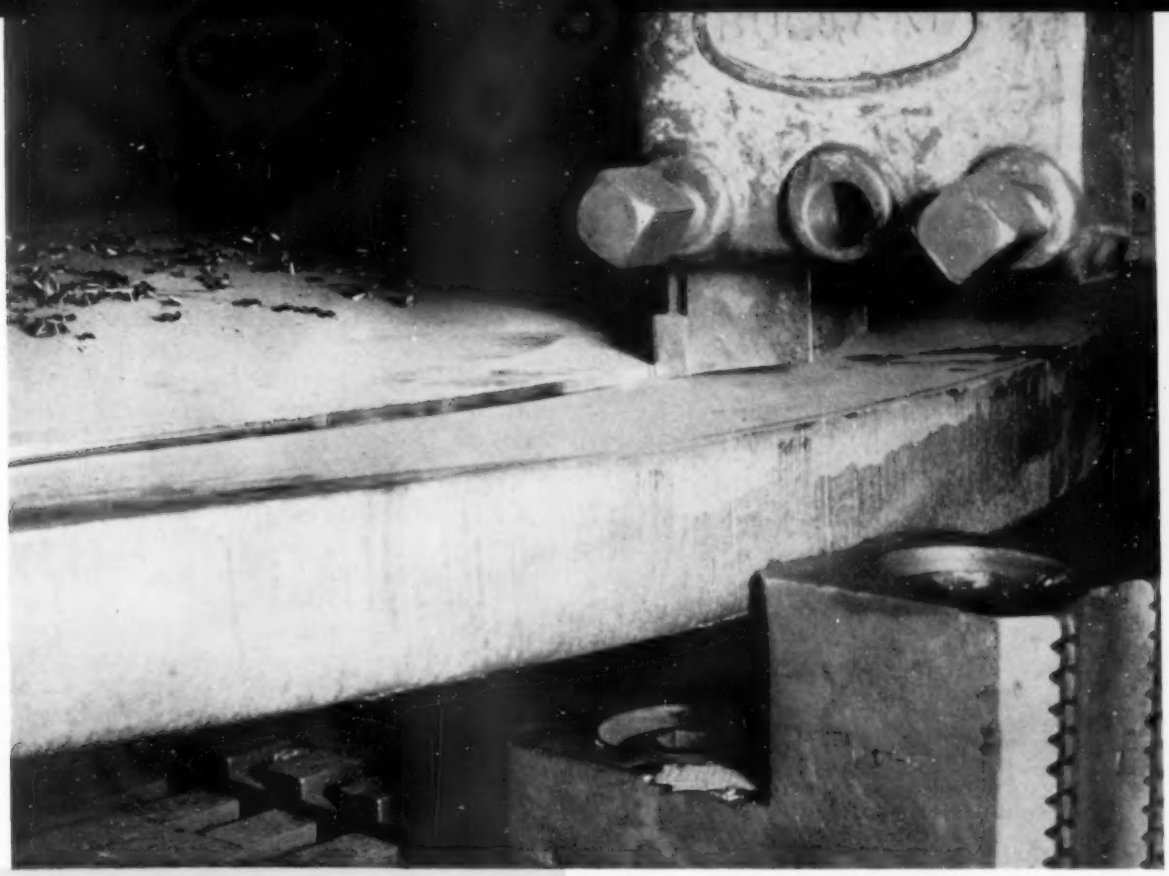


Fig. 1. Facing a cooler head on a vertical turret lathe. Material of the 40 x 2-inch workpiece is mild steel. Depth of cut is ¼ inch and feed is 0.020 inch per revolution. To maintain 350 sfpm at cut on head the speed is changed 3 times during the cut.

Increasing JOB SHOP PRODUCTION with Carbides

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Salt Lake City, Utah

***Senior member ASTE Salt Lake City chapter.**

WIDE VARIATIONS EXIST in the effectiveness and production attained through use of carbide cutting tools in machine shops. These variations are more pronounced in smaller general-purpose shops and maintenance and repair shops when contrasted with high production shops. There are several reasons for these differences.

Maintenance and job shops are involved in numerous operations of complex nature. By necessity, the machine tools must be heavy, multipurpose, *Fig.* 1, and, in some cases, improvised. It is frequently necessary to machine welded surfaces, hardened surfaces and reconditioned units of questionable machinability. Materials available for emergency replacement parts sometimes require excessive stock removal, due to inventory limitations and the time element. Machine operators are usually general machinists, capable of satisfactorily performing work on a variety of machines but inclined to take a dim view of radical changes in tool types, speeds and feeds.

Many shop supervisors, harassed by one or more of these factors, plus any number of equally disturbing problems which arise constantly in their operations have rejected carbide tools for routine opera-

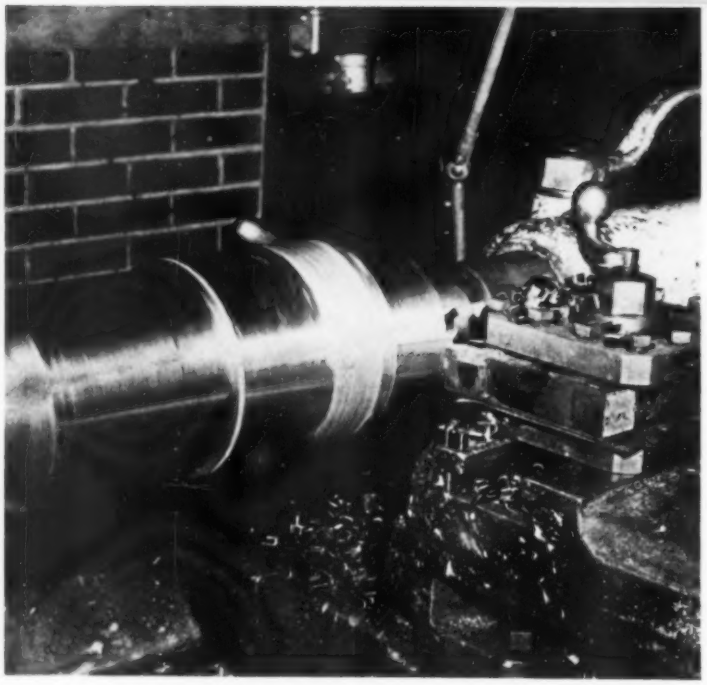


Fig. 2. Turning operation on a crane axle with a carbide tool. Material is SAE 1045 steel, forged and normalized to 160 Brinell hardness. The cut is ⅝ inch at 280 sfpm with feed of 0.032 ipr. Effective chip breaker action is clearly shown.

Fig. 3. Standard shanks for carbide tools: (*a*) boring, milling and light turning tools; (*b*) turning and facing tools: lathes 16 to 50 inch, horizontal boring mills, shapers, small planers. Code is in Table 1.

tions. However, they use carbide tools for materials that high-speed steel is unable to cut satisfactorily, *Fig.* 2. Prohibitive costs of the tools when used improperly may have influenced their decisions. Undoubtedly, the tendency of carbides to produce a long, treacherous chip when adequate chip breakers are not provided has also influenced the safety-minded supervisor.

When analyzed, objections to carbide tools raised by those who have not accepted them can be grouped into the following categories:

1. Safety factor.
2. Excessive breakage costs.
3. High cost of processing carbide tools.
4. Difficulty of training operators. There is often a conviction that available operators cannot be economically trained to use carbide tools.
5. Lack of confidence in carbide tools for the particular operations to be performed.
6. Belief that carbides cannot be used for finish cuts.
7. Conviction that any interruption in the cut, such as keyways or irregularities in a turning or boring operation, or the impact of the cut on planners, shapers and milling operations is immediately fatal to a carbide tool.

Anyone who fails to take advantage of carbides

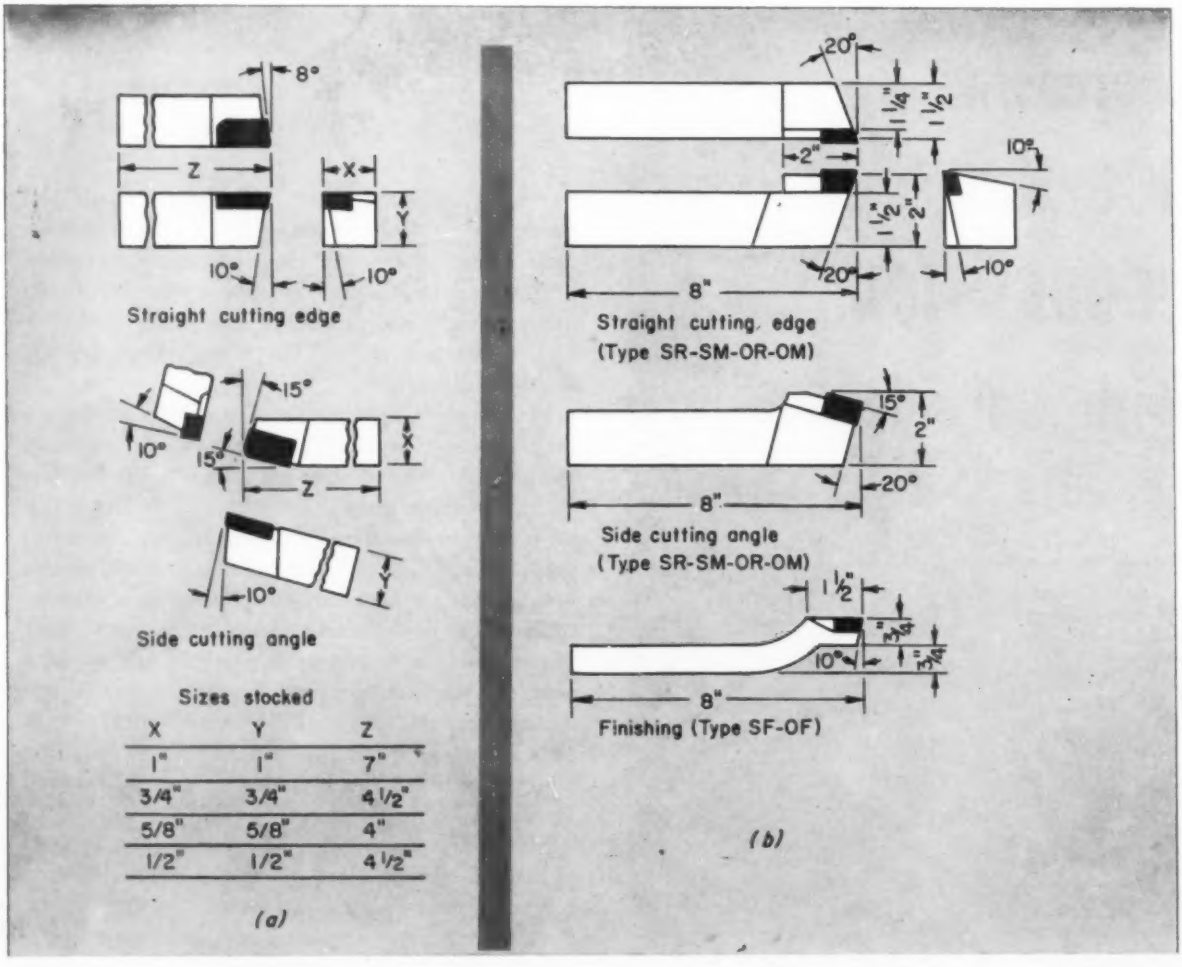


Table 1—Standard Code and Application Data for Carbide Tools

Color	Code	Material	Service	Speed (sfpm)	Feed (ipr)
Blue	SR	Steel	Interrupted cuts; scale welded surfaces; extreme hardness; sand or other inclusions in castings	150-250	0.035-0.060
Yellow	SM	Steel	Uniform roughing; rapid stock removal; rigid setup	200-350	0.015-0.030
Red	SF	Steel	Light high-speed finish cuts	400-600	0.002-0.010
Black	OR	Cast Iron	Interrupted cuts; sand or inclusions in castings; rough service	100-150	0.035-0.060
		Bronze	Interrupted cuts; sand or inclusions in castings; rough service	175-225	0.035-0.060
Silver	OM	Cast Iron	General roughing; rigid conditions; rapid stock removal	200-250	0.020-0.035
		Brass	General roughing; rigid conditions; rapid stock removal	250-400	0.020-0.035
Green	OF	Cast Iron	Light high-speed finish cuts	275-375	0.002-0.010
		Brass	Light high-speed finish cuts	400-600	0.002-2.010

Notes: Depth of roughing cuts should not exceed ¾ of the carbide insert length. Recommended depth of finishing cuts 0.002-0.015 inch.

for the foregoing reasons, is advised to reconsider because such objections are based on incomplete information. Success in the use of carbide tools is no secret. The necessary information is widely available. Many skeptics, however, insulate themselves from the evidence on the utility of carbides.

To reconsider the situation, the first step should be to visit a comparable facility where it is possible to see carbide tools in use. An alternative method would be to bring in a competent specialist, who is capable of establishing and maintaining a complete tool program.

In either event, absolute confidence is an essential factor. Once the responsible supervisor is convinced of the possibilities, he will naturally desire to expedite a program at the earliest possible date. A word of caution is necessary, however. Many tooling programs have been doomed to failure as the result of poor planning. A sound program will establish new standards of operation, and from it tremendous production benefits can be anticipated. To prepare thoroughly, the steps discussed in the following paragraphs are essential:

Survey of Tool Requirements: Standard shank sizes and styles should be established. A general-purpose tool must be sturdy. It must be versatile in order to be adaptable to different kinds and types of machines. Consideration must be given to the variety of operators who will be using the tool, the wide range of materials to be worked and the items to be machined. A frequent cause of tool failure is inability of the shank to withstand the pressures developed by the cut, or the shocks of an interrupted cut.

Another cause of failure is insufficient shank bulk around the tool tip to draw off heat generated in the cut. In the interest of economy and standardization, general-purpose shank types must be kept at a minimum. Suggested standard shanks are shown in *Fig.* 3. Included in this sketch are standard shanks for boring, milling and light turning tools. These tools can normally be purchased from carbide manufacturers at less expense than if they were fabricated in the shop. Also shown are standard shanks for turning and facing. These shanks were designed for use on all lathes from 16 to 50-inch and a variety of other equipment including vertical boring mills and small planers. The 1½-inch shanks supply rigidity and control the heat dissipation factor. Tool inventories and grinding problems will be simplified with the adoption of such standard shanks.

Selection of Carbide Grades: A minimum number of grades should be established as a standard for operations. Roughing and medium roughing tool grades should be chosen to withstand shock and heat. High-speed finishing grades should be of extreme hardness and have ability to withstand

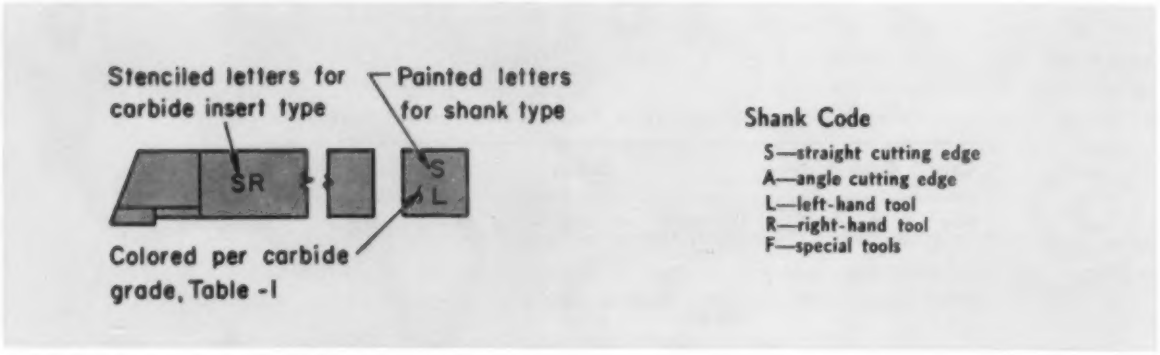


Fig. 4. Typical code for tool shank types shown in *Fig.* 3. End of shank is colored in accordance with color code shown in Table I for carbide types. Special tools, such as threading or form tools, carry only the letter "F" on the end of shank and are segregated from standard tools.

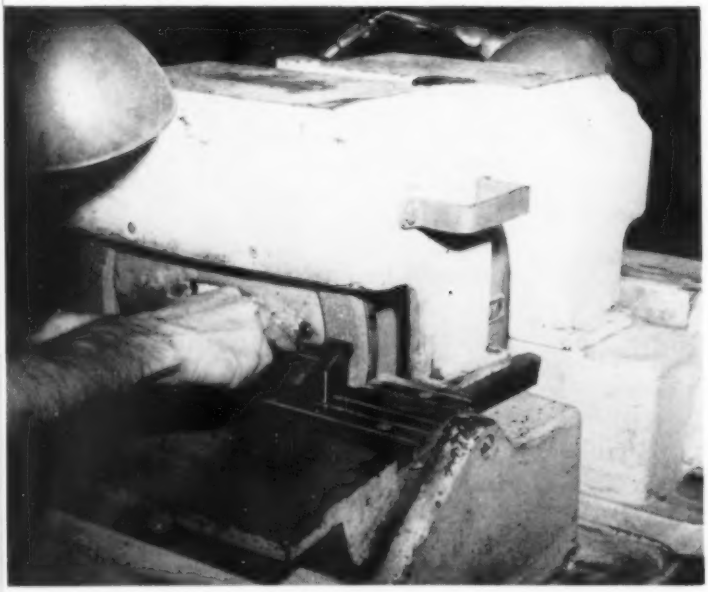


Fig. 5. Roughing of carbide tool being performed on a special tool grinder having a double wheel.[2] The semifinishing wheel may be silicon carbide of finer grit than the roughing wheel although diamond finishing is recommended.

wear at fast cutting speeds.

Suggested grades include only four types of tungsten carbide. TABLE I refers to six types of cutting tools. Type SR, a heavy-duty steel cutting tool, and type SM, a steel roughing tool use the same grade of carbide. Types OR and OM, cast-iron heavy-duty and medium roughing tools, also use a single grade carbide. The difference in these tools lies in the cutting edge and rake angles ground into the tools. Type SF, steel-finishing tool, uses a high-speed steel-finishing grade of carbide. Type OF, cast-iron or brass finishing tool, uses a high-speed cast-iron grade carbide. These four grades will adapt to most situations. Standardization effects desired economies since inventory requirements are minimized without limiting operations.

Preparation of Standard Coding System for Tools: Each tool should be clearly marked with the proper code. The coding system should be simple, so that all persons concerned can readily grasp the meaning of the colors or symbols, and yet it must be complete and exact. Codes must be easily and quickly recognized and completely standardized. Code interpretation charts should be posted conspicuously in toolrooms and tool cribs.

A typical standard code chart is included in TABLE 1. This particular code involves three factors: (1) a color code, (2) a letter code, and (3) a stencil code.

The color code for a given type of tool is painted on the entire butt end of the tool. This permanently ties that type of tool to the uses specified in the Service column. The tool is easily identified in storage. The color code also serves the supervisor with immediate information when he is checking operating conditions on the machines.

A letter code is painted on the butt end of the tool, against the solid color background, *Fig.* 4. This code designates straight or offset tools and specifies left or right-hand tools. This information is useful in tool storage and for other purposes of identification.

A stenciled code is used on the side of a tool shank. This coding refers to the carbide manufacturer's grade number and is not for general use. The coding is useful in the preparation room, for supervisor's information and for making or keeping permanent records of tool performance. As experiments are made with new or different grades of carbides, stenciled lettering provides the key to the manufacturer and the grade. In addition to these purposes the establishment of a standard coding system is an invaluable aid in conducting training sessions or in the daily instruction of operating personnel.

Revision of Grinding Facilities: Existing grinding equipment must be supplemented and revamped as necessary to provide adequate facilities for rapid tool servicing. A typical grinding setup, adequate for even large shops consists of three basic machines. These include, first, a special double-

wheel grinder, mounting two 14-inch silicon carbide wheels, *Fig.* 5. A 46-grit wheel is used on one end for all roughing operations. A 120-grit wheel is used on the other end for semifinishing operations, providing the diamond wheel finishing method is to be used. A 180-grit silicon carbide wheel may be used in place of the 120-grit so that diamond finishing may be bypassed for initial economy. Experience indicates, however, that diamond finishing considerably improves the performance of carbide tools and is an economical process when properly used. Second, a small converted carbide tool grinder, *Fig.* 6, may be used for finishing the cutting edges of tools. A seven-inch cup type diamond wheel, 180-grit, 100-concentration may be used on this machine. Third, a universal tool grinder, equipped with a double-angle vise and a 6-inch diameter by $\frac{1}{4}$-inch wide diamond wheel of 100-grit, 100-concentration, may be used to grind chip breakers, *Fig.* 7. Many shops fail to use ground-in chip breakers. Some attempt to break chips by increasing feeds. Others use clamped-on mechanical-type chip breakers.

The ground-in type chip breaker is recommended, however, for general-purpose use, *Fig.* 2. Long stringy chips are eliminated. The subsequent delays caused by entangled tools, work or machines are avoided. Also, the hazard to operators created by these stringy chips is eliminated. Chip disposal problems are simplified. In addition, excess tool breakage, resulting from the operator's attempt to control chips by increasing the feed beyond tool or machine limitations is avoided. The manual adjustment problem, where the operator continually adjusts a mechanical type breaker to suit his thinking, is obviated. Ground-in chip breakers are an excellent investment and quickly justify the expense of tooling to produce them.

Establishment of Standard Operating Procedures: Standard clearances and rake angles, tools and standard chip breaker specifications, *Fig.* 8, should be established for use in the grinding room. In order to insure uniform performance of tools, a clear and definite policy of grinding practice must be established. These standards must be determined and enforced before any degree of success can be achieved with a carbide program. Data for such standards are widely available from carbide

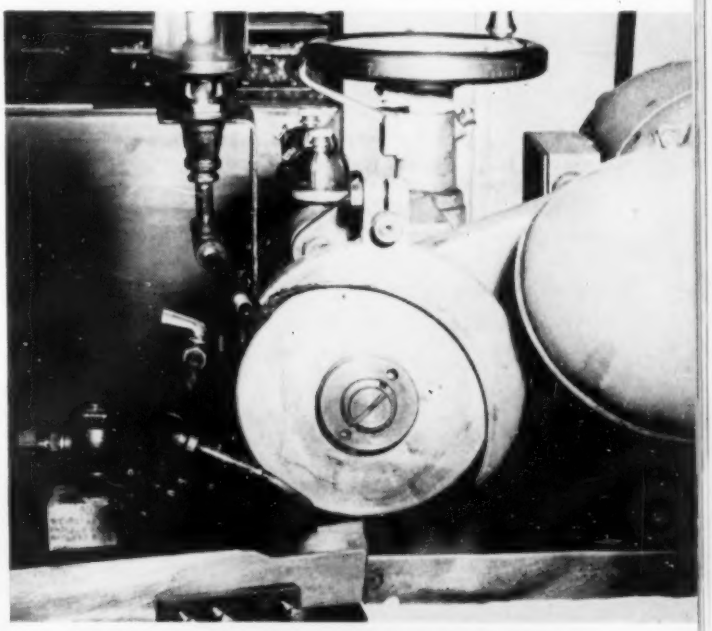
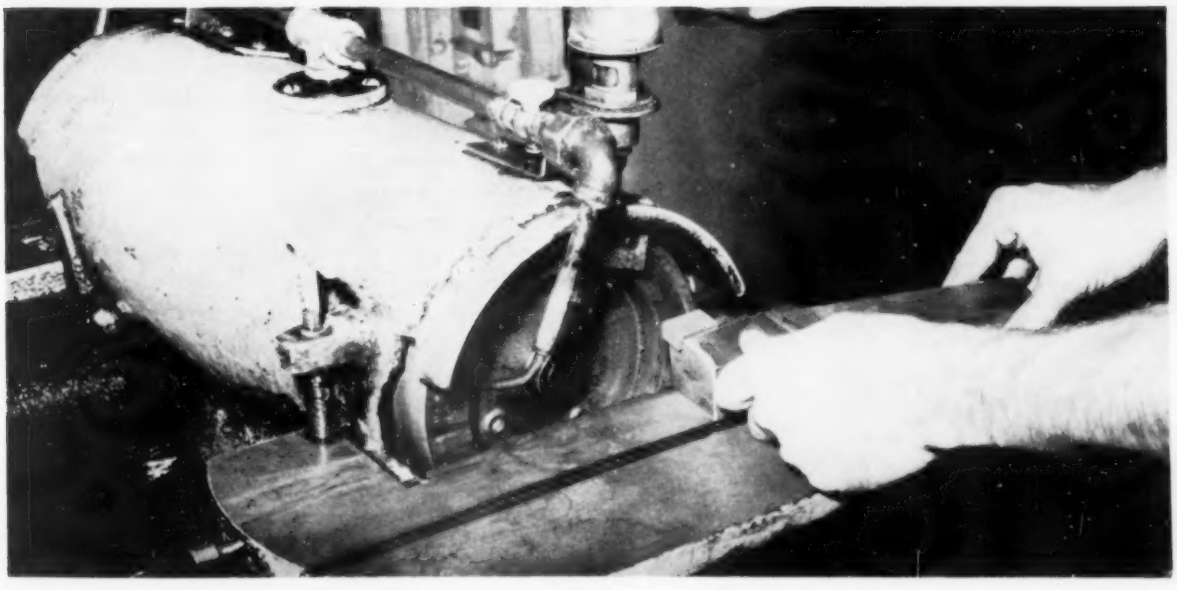


Fig. 6 (below) Finish grinding single-point tool on a converted carbide grinder with a 180-grit diamond, 7-inch cup type wheel.

Fig. 7 (right) Grinding chip breaker on single-point cutting tool with universal tool grinder. Tool is held in double angle vise.

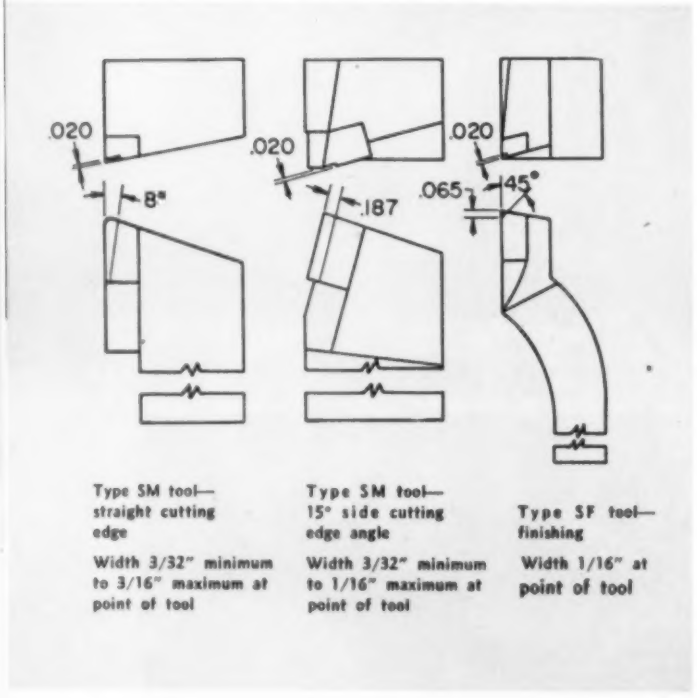


suppliers, handbooks and standards groups. A standard nomenclature chart is also useful in any standardization program to assure that all personnel involved speak the same language. This eliminates misunderstandings before they arise.

If the tools are fabricated in the shop, brazing procedures should be established and safeguards set up to be certain they will be followed. The importance of good brazing practice cannot be overemphasized. A system of tool issue and return must also be developed which will insure an ample supply of sharp tools and prompt return of used tools to the repair station. An adequate supply of tools should be secured to be kept in stock pending installation of the tooling program. As another preliminary, all personnel involved in the preparation and repairs of the tools must be thoroughly trained.

A final and most vital step of the program is the training of the machine operators. Usually a machinist, given a carbide tool without previous training will attempt to apply the principles accepted for use with high-speed steel and will immediately

Fig. 8. Typical company standard specifications for chip breakers in carbide cutting tools. Chip breaker rake angles duplicate the tool's specified rake angles.



experience unsatisfactory results or tool failure. Therefore, every employee in the shop who will use carbide tools should be given a thorough briefing in the use of the tools before they are made available to him. Experience has indicated that approximately four hours of combined lecture and shop demonstration will accomplish this purpose.

A suggested and proved training schedule would consist of two conferences, of no more than two hours each. The first conference should have the following objectives:

1. Give background information on the development and manufacture of tungsten carbide tools.
2. Outline briefly the brazing procedures used in attaching carbides to their shanks.
3. Outline briefly the procedure used in grinding carbide tools.
4. Outline briefly the factors considered in the design of carbide tools.
5. Outline advantages of carbides over high-speed steel, including shop demonstration of comparative metal removal rates.
6. Thoroughly instruct employees in principles and use of chip breakers on carbide tools with a shop demonstration. Also instruct on the effect of feeds, speeds and depths of cut for carbides.

Conference number two should accomplish the following objectives:

1. Instruct employees in the selection of proper carbide grades.
2. Instruct employees in the selection of shank styles and sizes.
3. Instruct employees in the application of carbides, including feeds and speeds.
4. Instruct employees in trouble shooting on carbide tool applications.

This second conference should include shop demonstrations on feeds, speeds, depth of cuts and precision finishing.

A carbide tool manual including speed, feed, surface feet per minute conversions, depth of cut and grade selection instructions should be issued to each employee and used as a reference during the conferences. Such manuals may either be prepared specially or available ones issued by carbide manufacturers may be utilized. The manual is important, however, in that it provides established standard reference data to suit variable conditions.

Conferences should be scheduled in such a manner that they can be held on consecutive days for participating groups. Groups should be limited to ten or twelve men each, to facilitate thorough participation and instruction. All employees should be processed in the shortest possible time. Immediately after completion of the training program, the tools previously prepared should be made available for use. In order to eliminate any remaining misunderstandings and to insure rigid adherence to standards established, an immediate and continuing follow-up on the job program should be activated.

If these steps are carefully followed a sound tungsten-carbide tool program will have been established suited to shop needs. Most of the usual apprehensions will never develop. Since the metal removal rate of carbide tools can be conservatively estimated at four times that of high-speed steel, the dividends in increased production will be proportionate.

Arc Welding for small-lot production

Part 2 – equipment and processes

By Arthur H. Allen
Cleveland, Ohio

Cost of any welded product includes the costs of preparing material for welding, direct welding and any necessary finishing operations. The consideration of such operations as cutting, forming, cleaning, stress relieving, painting and inspection is beyond the scope of this article, but such operations obviously must be a matter of concern in the production of weldments such as shown in *Fig.* 1.

Selecting the welding process and equipment for its application will be discussed in this article. The arc welding processes now in commercial use for welding steel are:

1. Automatic hidden or submerged arc welding.
2. Semiautomatic hidden or submerged arc welding.
3. Manual shielded arc welding.

For welding nonferrous materials and, experimentally, some ferrous materials, the processes used most frequently are: inert-gas shielded-arc, nonconsumable tungsten electrode and consumable metal electrode. Atomic hydrogen welding is used to a limited extent on nonferrous materials and alloy steels. It also finds some application on especially thin materials such as tubing.

Most production arc-welding operations are concentrated in the automatic, semiautomatic and manual metal arc-welding processes. The choice depends on both mechanical operating factors and economic factors such as production volume.

One of the first decisions to be made is whether to use alternating-current or direct-current equipment. Direct current has advantages on low-current applications, while on currents over 275 amperes, alternating current usually has advantages. The principal advantage of a-c over d-c is the reduction of so-called "arc-blow" which is often troublesome on jobs such as box sections weldments

Fig. 1. Welding a large press frame. Flexibility in hidden arc welding is realized with semiautomatic manual equipment. Smaller equipment investment and hand maneuverability permit using the advantages of hidden arc welding where fully automatic application is impractical.

Table 1—Manual Welding vs. Automatic Welding
(Based on 5/16-inch Fillet Weld)

Manual Welding		Feature	Automatic Welding	
Type B E-6012 ¼-inch	Iron Powder E-6024 ¼-inch	Electrode: Type AWS Class Size	Semi-automatic 5/64-inch	Full automatic 5/32-inch
350 a-c	350 a-c	Current—Polarity (volts)	475 Neg.	700 Pos.
0.13	0.20	Melt-off Rate (lb/min)	0.32	0.34
25	35	Arc speed* (ft/hr)	50	60
0.30	0.30	Electrode Used† (lb/ft)	0.20	0.20
0.12	0.17	Electrode Cost ($/lb)	0.22	0.20
5.00	5.00	Labor & Overhead ($/hr)	5.00	5.00
0.23	0.19	Total cost‡ ($/ft)	0.14	0.12
—	0.04	Savings ($/ft)	0.09	0.11

*Calculated arc speed using a 50 percent operating factor.
†Total weight of rod used, including stub and taking into account deposition efficiency and bead shape.
‡Total cost includes costs of electrode, labor and overhead per foot of weld. Cost of power has been eliminated as being approximately same in all cases and too small to consider.

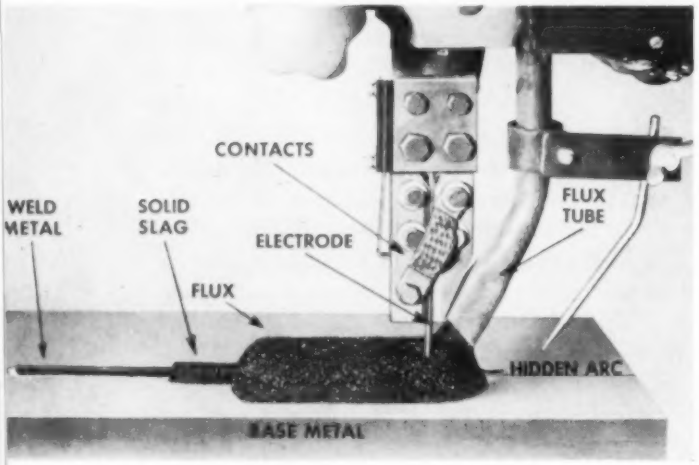


Fig. 2. Elements of automatic submerged arc welding.

Table 2—Manual vs. Automatic Welding Speeds

Material Size	Weld Type	Passes (No.) Manual	Passes (No.) Automatic	Current (amp) Manual	Current (amp) Automatic	Speed (ipm) Manual	Speed (ipm) Automatic*
10-gage sheet	Butt	1	1	180	650	24	100
½-inch plate	Butt	3	2	350	800	3.8	13.6
1-inch plate	Butt	8	2	350	1000	1.2	6.4
10-gage sheet	Edge	1	1	160	600	40	100
10-gage sheet	Lap	1	1	200	750	18	80
⅜-inch plate	Lap	1	1	375	625	10	36

*Use of Twinarc automatic welding will increase speeds listed under automatic welding by 40 to 70 percent.

where many different pieces must be joined into small assemblies. Welding speeds are usually higher with a-c equipment because of the elimination of arc blow. With d-c, currents sometimes must be reduced to control the arc blow.

Arc blow refers to a condition in the welded joint which causes the arc stream to waver from its intended path. During welding, current flows through the electrode, the arc stream, and the base metal, setting up magnetic fields around these three elements. The action of these magnetic fields sometimes combines to pull the arc stream away from its intended path resulting in failure to fuse the joint properly. The blow may either be in a forward direction ahead of the arc or in a backward direction behind the arc.

Correctives for back blow include welding toward a heavy tack weld or toward a weld already made; welding away from ground; correcting electrode manipulation; holding as short an arc as possible; backstepping technique on long welds and placing the ground connection as far as possible from the joint to be welded. Forward blow is sometimes encountered with electrodes of the types that create heavy slag deposits. Forward blow causes the slag to crowd the arc. Corrective for this condition is the reverse from backward blow, i.e., welding toward the ground.

Most a-c units are single-operator transformer type welders that can be provided with power factor correcting capacitors arranged for a factor of 80 percent lagging at rated load. Capacities are 180, 200, 250, 300, 400, 500, 750, and 1000-amp.

Practically all d-c equipment is of the variable-voltage type. General-purpose job-shop work and light industrial applications are handled by 180 and 250-amp, 30-volt generators. Manual production welding generally calls for 200, 300 or 400 amp, 40-volt welders. Larger 600-amp units, occasionally arranged in parallel pairs, are used almost exclusively for automatic or semiautomatic hidden-arc welding as well as carbon-arc cutting.

The d-c welder is somewhat more versatile than its a-c counterpart, handling all types of metal and all kinds of welding jobs, including nonferrous and alloy materials. Where no power supply exists, an engine-driven d-c generator may be used.

The question usually arises as to whether to

select straight or reversed polarity for the welding current. In general, and especially with automatic processes, electrode negative gives higher melt-off rates, while electrode positive gives better penetration and less porosity. In manual welding, however, melt-off conditions are affected differently by different types of coatings and the recommendations of electrode suppliers should be followed.

Since welding costs break down to 86 percent for direct labor, 8 percent for electrodes and supplies, 4 percent for equipment amortization charges and 2 percent for power, it is essential that the highest speeds possible—consistent with weld quality—be realized for the lowest over-all cost. Seven fundamentals govern most welding procedures:

1. Travel electrodes as fast as possible within the limits of good weld appearance.
2. Use the largest electrode size practical.
3. Use the highest possible current.
4. Use as short an arc as possible, dragging the electrode coating where this can be done.
5. Use proper fit-up and preparation of material.
6. Keep weld metal build-up to a minimum.
7. Choose the steel analysis most readily weldable.

Contrary to a concept which persisted for many years, high welding speeds give greater penetration, while slower speeds tend to build up more metal on the surface. A fillet weld, for example, with greater penetration (resulting from faster travel speed) appears smaller but its strength is actually as great or greater than the weld made at slow speed with a sacrifice of penetration for build-up.

Automatic Welding

Selection of the most economical welding process often boils down to a matter of weighing "arc-speed potentials" of the different methods. A typical comparison is given in TABLE 1.

This tabulation would suggest that the automatic hidden-arc processes have significant advantages over the manual techniques, and indeed they have where they are applicable and where production justifies the investment. However, a number of limitations surround automatic processes, and they must be recognized. Foremost is the difficulty of adapting them to out-of-position welds. A poor fit-up also rules out automatic welding.

Where a considerable length of straight, uninterrupted joint is to be welded and the aim is to get a substantial amount of weld metal laid down in the shortest possible time, the automatics are ideal. An example is in the fabrication of large tanks or other cylindrical vessels where both longitudinal and circumferential seams can be traversed rapidly under an automatic head and completed in a fraction of the time required by manual welding, and at a considerable gain in quality and appearance.

Illustrating primarily the effect of increased current on speeds, a further comparison of manual versus automatic welding on six applications is presented in TABLE 2.

Principle of the automatic hidden-arc process of machine welding involves the deposition of a granular flux on the joint to be welded in sufficient depth to cover the completed weld, *Fig.* 2. Bare metallic welding electrode wire is power-fed into the blanket of flux, the rate of feed being controlled automatically for correct arc length. Direct current produces the hidden arc between the electrode and the joint, fusing the parent metal and the electrode to make the weld. Flux adjacent to the arc melts.

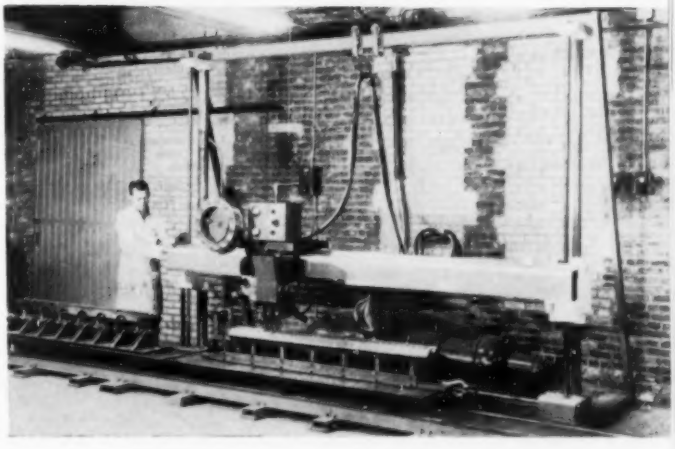


Fig. 3. (top right) In this setup the automatic welding head remains stationary while the work, mounted on a positioner, is revolved under the head at a constant speed.

Fig. 4. (right) Welding head is moved on a travel carriage mounted on an adjustable beam. The work remains stationary during welding. Work is in a fixture on a dolly for moving in and out of the welding station. Two fixtures are provided so that one can be loaded while the other is being welded.

Fig. 5. (above) Third alternative for automatic welding is the self-propelled tractor which permits taking the equipment to work which is not practical to position. A large tank is being welded.

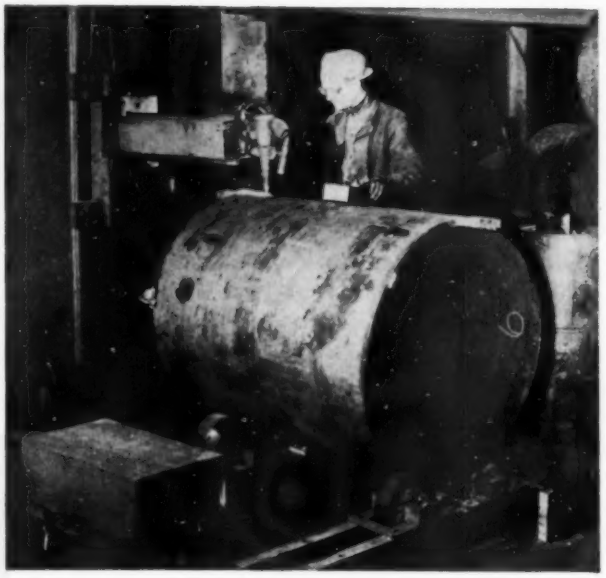


Fig. 6. (right) Boom of welding machine can be moved up and down or in and out. It mounts the welding gun of the semiautomatic welder which, in effect, makes this equipment automatic. A boom type welder is versatile and can be adapted to many small quantity jobs.

floats on the surface of the molten metal, then solidifies as slag on top, eventually peeling off readily to leave the weld bright and smooth. Since the arc and molten metal are blanketed by flux at all times, the weld is completely protected from contact with the atmosphere, thereby avoiding oxidation, eliminating spatter, arc rays, smoke and the need for weld cleaning.

As indicated in TABLE 2, speeds three to four times those of manual welding are possible. However, fit-up of the parts to be joined must be accurate and unvarying, since the welding head cannot compensate for variations in joint openings. At the same time, the high current gives exceptionally deep penetration and often eliminates the need for edge preparation beveling on heavy plates.

The hidden arc system is adaptable to three general types of equipment setup:

1. Stationary, with the work being moved mechanically under the welding head, *Fig.* 3. This arrangement is suited to repetitive production of small assemblies, especially those with circular welds which are much more easily moved than the automatic head.
2. Mounted on a travel carriage, with the work stationary, *Fig.* 4. This setup is used where size or design of the part and its assembly jig makes it simpler to move the head over the work. Special travel carriages and fixtures can be designed for a wide variety of fairly complicated assemblies.
3. Mounted on a self-propelled tractor with work stationary, *Fig.* 5. The tractor, guided by hand, carries the head along the seams. This is an excellent technique where long, flat welds are involved or where a variety of odd shapes are to be welded.

Cost of fixtures and other tooling for fully automatic welding operations is apt to be on the high side, although entirely economical on many jobs. It is not uncommon to see fixtures which cost $10,000, several times the cost of the welding equipment itself. However, they are designed to "pay out" over the production run by virtue of the savings in unit welding time.

Semiautomatics Are More Flexible

Weighed against the footage of welding to be done in a given time, it might be that an automatic job would prove to be overtooled, in which case consideration should be given to the possibilities of a semiautomatic setup. Compared with manual welding, the advantages of increased welding currents and higher speeds can be realized without an inordinate investment in fixtures.

A lightweight welding gun, *Fig.* 1, which feeds both electrode and granular flux automatically while being guided by hand, gives such advantages and has come into general use on small production runs made in the flat or near-flat position. Up to 600 amp may be used on $\frac{5}{64}$ or $\frac{3}{32}$-inch electrode wire with this type of equipment, giving deep penetration. As an illustration, 100 percent butt welds

Table 3—Welding Speeds with Iron-Powder Electrodes

Electrode Size (in.)	Current (amp)	Polarity (current)	Fillet Size (in.)	Arc Speed (ipm)
5/32	225	a-c	7/32	15
5/32	200	d-c (+)	7/32	12.5
3/16	275	a-c	1/4	15
3/16	250	d-c (+)	1/4	12.5
7/32	300	a-c	9/32	15
7/32	270	d-c (+)	9/32	12.5
1/4	350	a-c	5/16	14
1/4	300	d-c (+)	5/16	12

may be made in ¾-inch square-edge joints with a single pass from both sides. Further, negative polarity may be selected for faster melt-off in fillet welding or in the event of a poor fit-up. Welds are smooth, the slag peeling off after cooling.

Versatility and flexibility of the semiautomatic idea commend it to small-lot production. Used in combination with a standard weld positioner, *Fig.* 6, the hand-traveled gun can be shifted quickly from one job to another.

Manual Welding

The smooth appearance and self-cleaning characteristics of hidden-arc welds are potent factors governing the choice of this method. However, a recent innovation in shielded-arc electrodes has made it possible to produce comparable welds with conventional manual techniques. It is a drag-type electrode carrying a heavy refractory coating containing a substantial percentage of iron powder. This permits higher currents for higher welding speeds. Designed for welds in the flat and near-flat position, it can be employed with either a-c or d-c, preferably the former.

This electrode gives physical properties comparable or better than the regular F-6012 type B coated electrode and is particularly suited to welding the higher carbon steels, *Fig.* 7. First introduced by Lincoln Electric in 1953 under the trade name, Jetweld, its principles of functioning are:

The electric arc drawn from the end of a welding electrode does three things—melts the core wire, melts the electrode coating and melts the edges of the parts to be welded. An increase in welding current boosts the speed with which the arc can carry out these actions but, for a given size electrode, there is a limit to the maximum usable current beyond which there will be breakdown of the coating, too much penetration, gouging of the parent metal or excessive spatter.

Electrodes with metal powder in the coating use the high current heat of the arc more efficiently in melting the iron powder. Hence it is possible to increase speeds and avoid the troubles encountered with conventional electrodes. If, for example, an electrode coating contains sufficient iron powder to supply one-third of the deposited metal, with the remaining two-thirds coming from the core wire, metal deposition can be up to 50 percent faster than with the same size of conventional rod, *Fig.* 8. Typical currents and arc speeds with the new electrode are tabulated in TABLE 3.

Iron powder electrodes are available in several types. One, classed as E-6024 is designed for flat and horizontal fillet welds. The electrode also meets the requirements of standard E-7020. Another type is classed as E-6727 and is for deep groove welding. Low hydrogen iron powder electrodes are also available. These electrodes may be used either with a-c or d-c current, the preference being for a-c, with which somewhat higher speeds may be obtained.

Granted the higher speeds of hidden arc welding and ironized-coated electrodes and the contributions they make to the over-all economy of welding, engineers frequently encounter resistance in applying these new developments. Supervision may retard the use of welding simply through reluctance to face a set of new problems that might be created. Workers may feel they are "killing the job" with these improved tools. Intelligent handling and education are frequently required. It is foolhardy to force what may seem to be obvious advantages. Fortunately, in the case of the new electrodes and automatic welding, the ease of operation and better working conditions that accompany their use have hastened their acceptance by factory personnel.

The next and final article in this series will discuss tooling for the job. The author acknowledges the helpful assistance of the Application Engineering Department of The Lincoln Electric Co. in supplying photographs and data for this article.

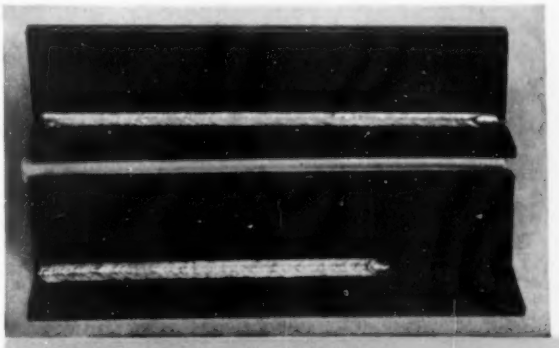


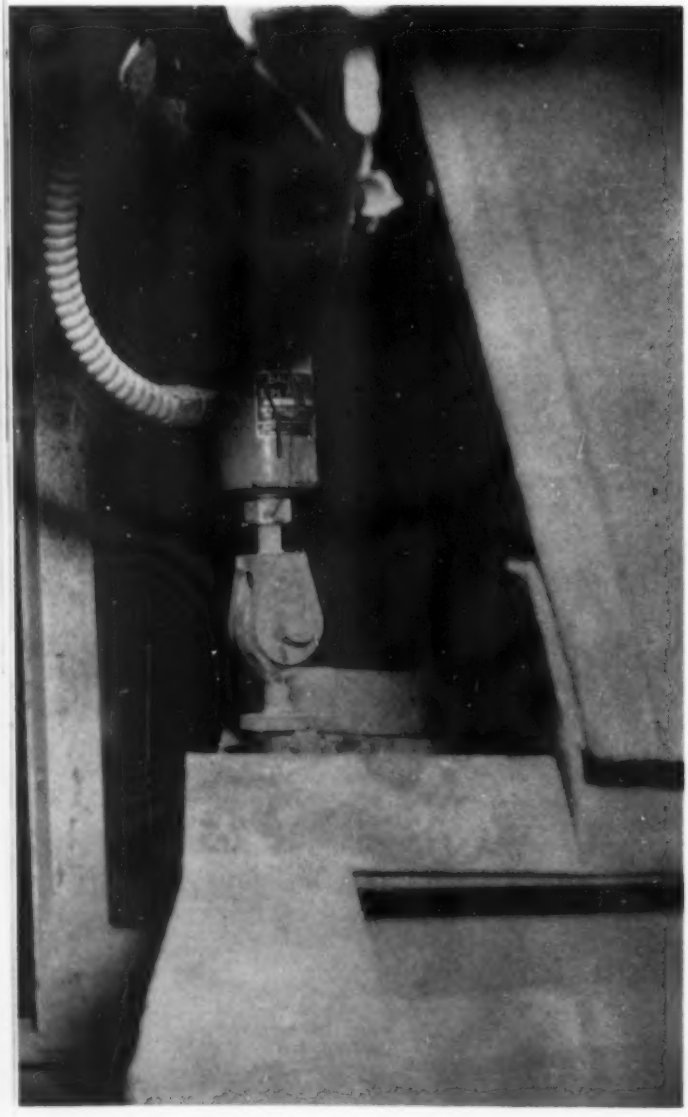
Fig. 7. (top right) Both fillet welds were made with a single 14-inch electrode, the top with an iron-powder electrode and the bottom with a conventional E-6012 electrode. Iron-powder electrode proved to be 36 percent faster and weld has better appearance.

Fig. 8. (right) Using a-c equipment, flanges and brace plates are welded to 7-inch solid steel round leg for TV tower. Fabricator claims savings of 50 percent with iron-powder electrodes. Positioning equipment is power driven.

designed for

PRODUCTION

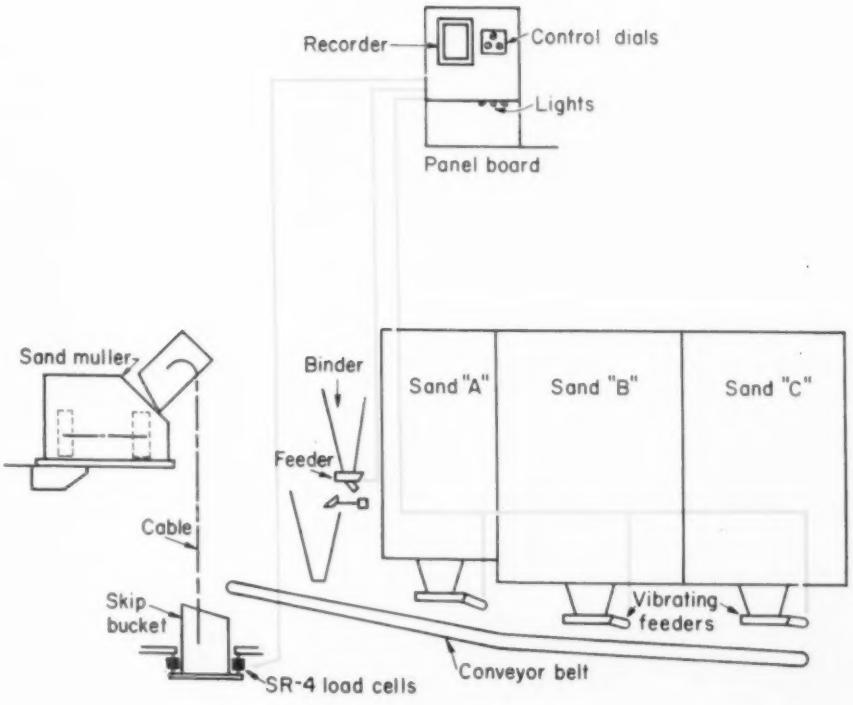
Load Measuring Device Assures Molding Sand Quality



To achieve accurate control of the physical properties of mold sand and speed up production, an electronic method has been developed for controlling sand mixes. As applied, it assures accuracy and reproducibility for molds used in pouring quality steel castings. A strip-chart recorder provides a continuous check on proportions. Heart of the system is a series of three SR-4 strain gages made by Baldwin-Lima-Hamilton, Philadelphia, Pa. These resistance-wire strain gages are calibrated to indicate weight by deflection and are installed in a system at the Granite City, Ill. plant of General Steel Castings Corp.

Use of the system has increased production of mulled sand about 15 percent and improved the consistency of physical properties. In terms of standard foundry indexes, sand with a moisture of 3.4 to 3.8 percent is held to a green strength of 6.5 to 7.0 psi and a permeability of 165 to 195. Weight accuracy has been near 1 percent for an 1800-lb batch, regardless of moisture content, height of sand in bins or conveyor cleanliness. This is reported to be a great increase over former methods using electrical feeders and timers.

TOTAL WEIGHT of molding sand in the skip bucket is measured electrically by three 2000-lb SR-4 tensional load cells to assure proper proportions of sands before the bucket is elevated to dump into the sand muller. Use of tensional load cells permits protection against impact overloads from the falling bucket, should the cable break, and during normal operation. Springs and oak shear pins are used in the suspensions for the platform on which the bucket rests. Notched plates on the bottom of the bucket guide it onto inverted angles to free the bucket wheels from the vertical channel tracks on which it is raised and lowered. A limit switch on one side of the bucket prevents start of filling cycle until bucket is in place.

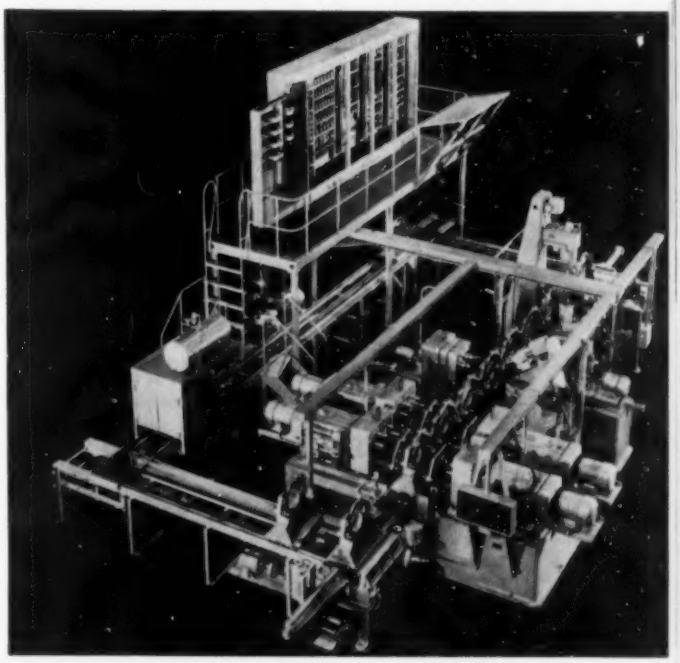


SCHEMATIC DIAGRAM of automatically controlled mold sand handling and proportioning system shows skip bucket, load cells and sand conveyor passing under bins and binder hopper. Control dials are set on the panel board for delivery of correct amount of sand on the conveyor from each bin. Delivery can be set for up to 3000 lb in 20-lb increments. Each sand is fed to conveyor by itself with 20-sec delay between types of sand so delivered quantity can be checked by load cells. Binding materials are automatically measured and added independently. The load-cell circuit prevents raising of the skip if the total delivered weight is incorrect. If more than 30 lb of sand remains in the bucket from the previous mix, the program cannot begin.

Automatic Transfer Machine

Built from Standard Elements

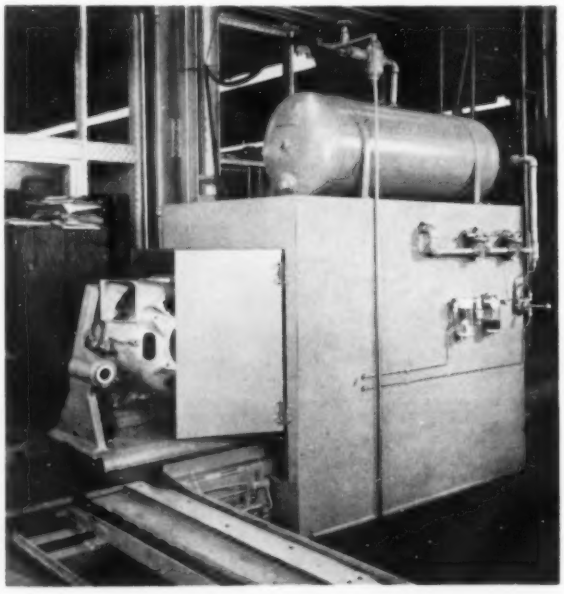
Existing components of proven design have been combined into a 12-station palletized transfer machine capable of performing a total of 5520 drilling, reaming and tapping operations per hour on die-cast aluminum torque converter housings. Modern Tool Works, Ltd., Toronto, Can., built the machine of units so it could be versatile. The machine can be adapted to meet part design changes or can be completely retooled. Additional work stations can be added easily. Design aim was to



MAIN BODY OF THE MACHINE is made up of three main sections (right), each section providing two working positions for the fixtures, a corner section at the load end and a corner section at the discharge end. An idle station is provided between these sections to provide ample space between units for tool change and setup. Fixtures are automatically returned from the discharge end to the load station by three synchronized conveyor sections. Twelve machining units, mounted on suitable wings, are arranged about the three main sections.

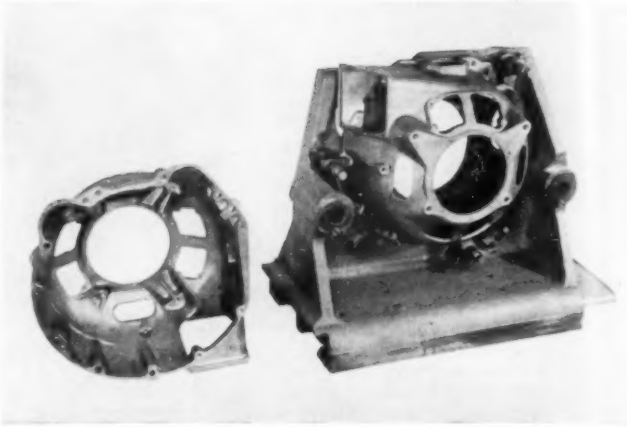
reduce the "special" content of transfer machines to a point where the tooling will be the only special equipment.

All electrical control equipment is contained in a cabinet on a mezzanine directly above the rear conveyor section. Wiring to the machine is contained in overhead steel ducts supported on steel posts. Hydraulic power for the machine, with the exception of four self-contained hydraulic feed units, is supplied by a power pack located beside the rear section of the conveyor. All piping to and from the machine is suspended below the overhead electrical ducts for ease of maintenance and alteration and to enhance appearance.



AUTOMATIC MILLING MACHINE

controlled by light templates



WORK HOLDING FIXTURES hold components in an upright position. When the part arrives at this machine, its engine facing side has been machined and it is from this face that the component is located. Parts are clamped at three points with screw type clamps arranged to prevent distortion. The clamps are actuated by a portable impact wrench located at the load station. The underside of the fixture comes in contact with the ways and is faced with hardened steel inserts to resist wear. Fixtures are moved hydraulically from one position to another, under positive control at all times, by means of a sectional transfer bar running the length of the machine. This bar rotates at the end of its stroke so it can be returned for the next stroke. Fixtures are accurately located at each position by a series of shot bolts. When located, fixtures are clamped on the ways by the action of a hydraulic cylinder which forces a short section of way to swing out.

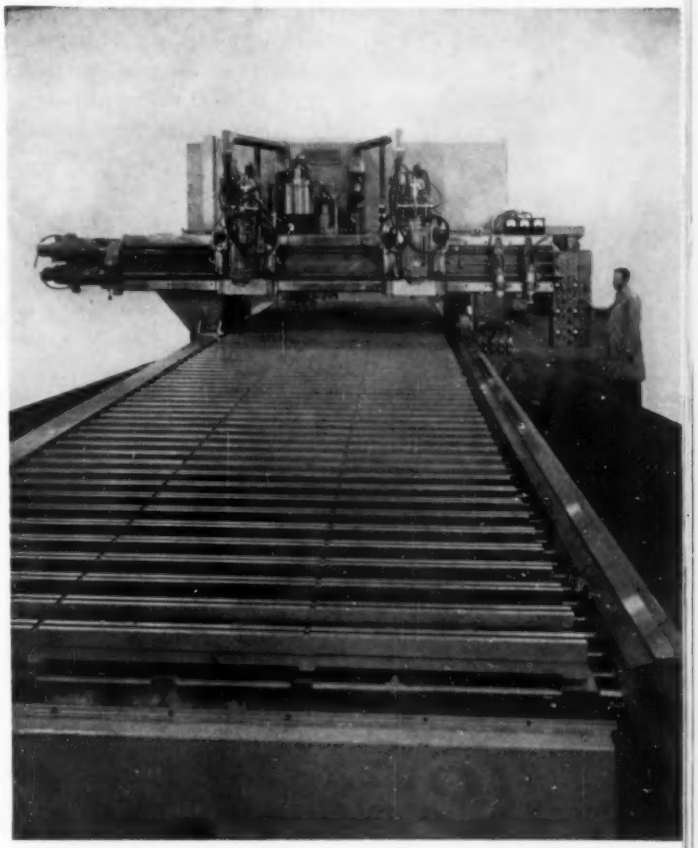
A CHIP BLOW-OFF STATION is located on the rear conveyor section. During the machining cycle, a loaded fixture containing a finished part, is stopped inside this housing where a manifold of air jets blast off the chips.

Designed to shape the intricate aluminum parts required in airframes, this machine does the work of three: skin milling, spar milling and profile milling. Another unusual feature of the machine is its ability to perform accurately with templates no thicker than $\frac{1}{8}$ inch. This is possible because the motor cutter units are electronically tracer controlled. Templates for this machine, built by Onsrud Machine Works, Inc., Chicago, Ill., can be made easily and more can be stored in a given area.

The model illustrated has three cutting heads

but four can be installed. The three heads are capable of taking contour, profile and angular cuts simultaneously. Table and beds are stationary with the cutting heads mounted on a gantry carriage. Additional bed units can be added at any time.

The two 60-hp vertical cutting heads can be driven by a single motor or by individual motors. Angular and vertical control can be tied together or separate. The left-hand cutter unit has a dwell area on the left side of the machine so the right-hand cutter unit can cover the full width of the table. The left-hand cutter can cover $\frac{2}{3}$ of the table width.



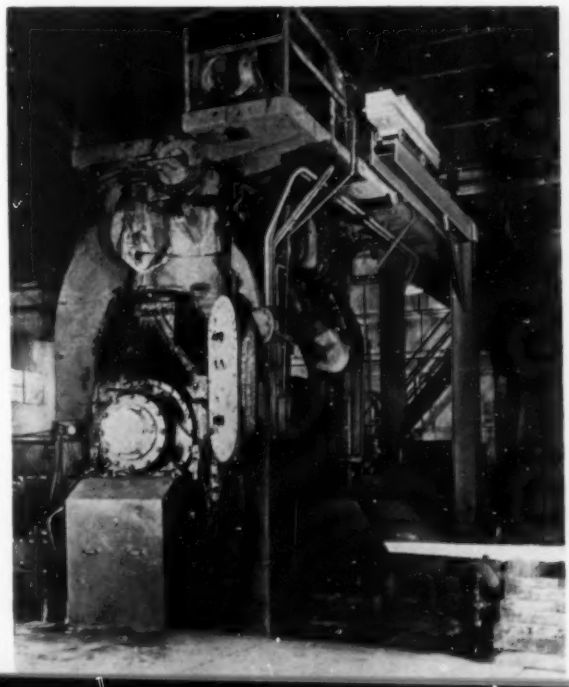
THE THREE HEADS are an "invomilling" head and two vertical 60-hp cutter heads for profile and skin milling work. The invomilling head performs profiling operations with three-way feed and a pneumatic compensator, enabling fast, accurate cuts to be taken on corners as well as in a straight line. Transverse motion is controlled by a single dimensional tracer unit mounted on the cross rail. For vertical and angular movements, a selsyn control is used. Templates for these movements can be placed at the outer extremity of the machine and no physical tie is used between the follower and the cutter head. The outboard selsyn arrangement makes it possible to group a bank of seven templates for each possible cutting head, enabling 28 motions.

HOT STRIP GAGE

measures by infrared radiation

Measuring width of red-hot steel strip accurately as it travels at rates up to 2000 fpm is now possible with the Infra-Ray gage. Developed by Industrial Gauges Corp., Englewood, N. J., this gage allows continuous measurement of the strip, instead of the end only, which is the least representative portion.

This gage operates by scanning across the full width of the hot strip and several inches beyond both edges. Discontinuity of the radiation signal

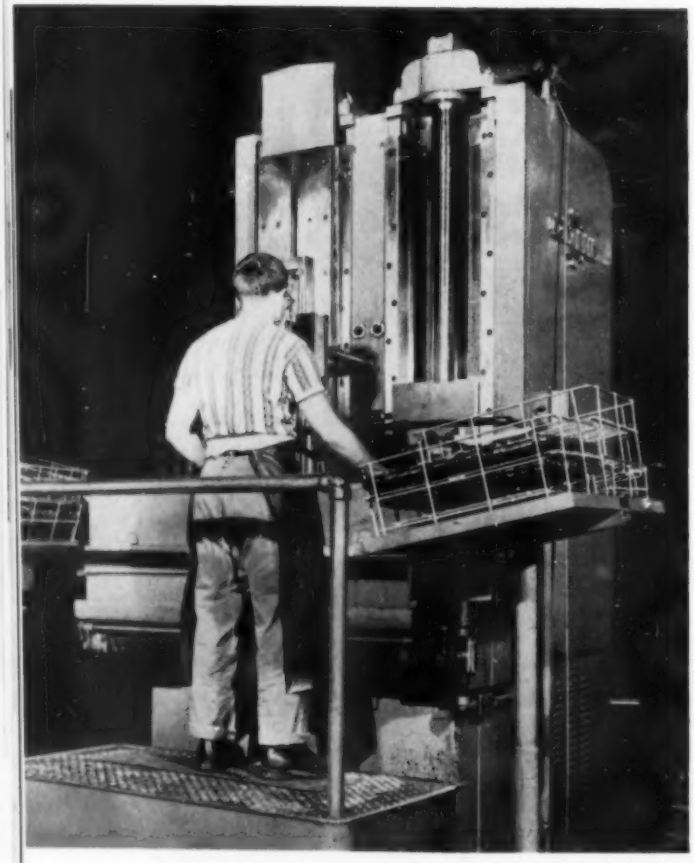


GAGE HEAD is located from 10 to 20 feet above and as close to the entry side of the last stand as possible. Located in this position, the gage will give a true width reading because the strip is held flat. Tilted or bowed strip would give a foreshortened reading. Also, all work has been done on the strip by this stand so results of the entire rolling process can be checked.

at the edges is projected onto a time axis and then converted into a measurement of width. Strip can be 3 inches to 10 feet wide and the edge temperatures can range from 900 to 2000 F. Sensitivity is important because edge temperatures of thin strip may produce rays below the visible range.

Accuracy of the gage is $\frac{1}{8}$ inch on wide strip, less on narrow strip, when the centerline of the carriage is within 1 inch of the center of the strip. Only moving part in the gage is a ball-bearing mounted motor shaft. The gage is water cooled, hermetically sealed and mounted to resist shock.

THREE SURFACES BROACHED
in three planes



OPERATOR PLACES LEVER between locating fingers for straddle-broaching operation on the left ram and then clamps the part in place hydraulically. The work platen, with the fixture, moves under the ram and the locating fingers are automatically withdrawn. At the same time, the right-hand platen shuttles back into loading position. The left-hand ram completes its work stroke and the right-hand ram moves to broaching position. A part is placed in the right-hand fixture and hydraulically clamped in place. The right-hand platen shuttles into broaching position and the V-slot is broached.

Broaching three different surfaces of transmission reverse band levers requires a versatile machine and unusual tooling. Colonial Broach Co., Detroit, Mich., furnished the machine and the tooling. Opposite sides of the lever boss have to be finished as well as the external V-slot. It was decided to straddle broach both sides of the boss in one pass and finish the 55-deg slot with a separate pass. With a dual ram machine, one part is finished for each machine cycle. Production rate is 160 parts per hour, which allows 9 sec to unload and load each ram.

LOCATING THE LEVER BOSS is critical because the same amount of material must be removed from both sides of the boss and part geometry precludes locating anywhere else but on the faces to be broached. To overcome this problem, a fixture is used that combines automatic locating fingers and hydraulic clamping. The locating fingers pivot into and out of position with the shuttle motion of the work platens, leaving the work area clear for the double-face broach to straddle the boss.

gears and splines

. . . checking pin measurement data

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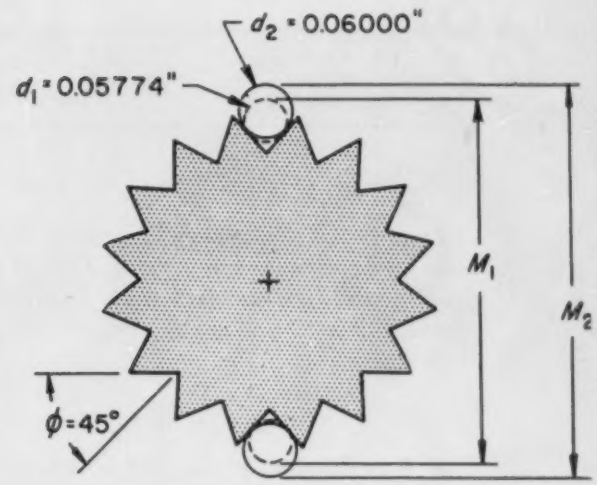

Fig. 1. Diagram of methods used with angular profiles.

CALCULATION OF MEASUREMENTS over and between pins for gears and splines is subject to various types of errors. To prevent costly mistakes, all calculations should be double checked. To repeat the calculation, using the same procedure, does not represent a true check because the same error may be introduced.

If two persons make the calculations separately from the same data, the chance of their arriving at the same incorrect answer is remote. Small shops usually depend on one man for calculations of this type and he should use an entirely different set of equations to give a reliable check to his work. Error paths, such as pushing a wrong button on the calculator, picking a wrong value from tables, transposing digits in numbers, interpolating incorrectly, omitting the term for odd number of teeth, using incorrect data and locating the decimal point incorrectly would not be repeated in the same way in different methods.

Pin sizes specified on parts drawings are frequently unavailable in the shop. A substitute size must be used and the correct measurement over the available pins must be determined. The new measurement is calculated by conventional methods but must be checked. Also, some internal and external involute gears and splines must be checked for profile accuracy by measurements over three or four sizes of pins. This is necessary when workpieces are too large or too small for involute checking machines and when a profile check is required during manufacture. Such multiple measurements must be checked for accuracy. When tooth thickness is given and the pin measurement must be computed, especially if tooth thicknesses and pin diameters are not standard, a double check is necessary.

These possibilities fall into five types and each will be handled separately. For simplicity, the formulas indicating change in measurement for each type and the ranges indicating use of each type are shown in the table. Only the methods used for the double check will be outlined. Because problems for odd-toothed gears would be handled in the same manner, but with different formulas as shown in the table, only even-toothed gear examples will be used. Each type will be illustrated.

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Five Double-Check Methods and Associated Formulas

Type	Amount Pin Diameter Is Changed (Δd) (inch)	Change in Contact Angle (deg)	Change in Measurement — Even Teeth (inch)	Change in Measurement — Odd Teeth (inch)
I	Any change within profile limits	None (serrations and angular profiles)	$\Delta M = \Delta d\ (\csc \varphi + 1)$	$\Delta M = \Delta d\ (\csc \varphi \cos \frac{90}{N} + 1)$ — φ is given
II	Small change 0.0001 to 0.0020	0.5 or less	$\Delta M = \Delta d\ (\csc \varphi + 1)$	$\Delta M = \Delta d\ (\csc \varphi \cos \frac{90}{N} + 1)$ — φ must be computed
III	Medium change 0.0020 to 0.0200	0.5 to 3.0	$\Delta M = \Delta d \left[\csc\left(\frac{\varphi_2 + \varphi_1}{2}\right) + 1\right]$	$\Delta M = \Delta d \left[\csc\left(\frac{\varphi_2 + \varphi_1}{2}\right) \cos \frac{90}{N} + 1\right]$ — φ_2 and φ_1 must be computed
IV	Large change 0.020 and up	3.0 or more	$\Delta M = \Delta d \left[\csc\left(\frac{\varphi_2 + \varphi_1}{K}\right) + 1\right]$	$\Delta M = \Delta d \left[\csc\left(\frac{\varphi_2 + \varphi_1}{K}\right) \cos \frac{90}{N} + 1\right]$ — φ_2 and φ_1 must be computed
V	Any change within profile limits	3.0 or more	$\Delta M = \Delta d \left[\csc\left(\frac{\varphi_2 + \varphi_M}{K}\right) + 1\right]$	$\Delta M = \Delta d \left[\csc\left(\frac{\varphi_2 + \varphi_M}{K}\right) \cos \frac{90}{N} + 1\right]$ — φ_M is given and φ_2 must be computed

Type I: The simplest cases of changes in dimensions over pins are found with symmetrical angular profiles, such as circular racks, serrations and screws with small lead angles. The following equations apply:

$$\Delta M = \Delta d\ (\csc \varphi + 1)$$
$$M_2 = M_1 \pm \Delta M$$

If an even-toothed 90-deg SAE serration is being made and the size measurement is indicated over 0.05774-inch diameter pins, *Fig.* 1, what would be the measurement over 0.06000-inch diameter pins?

$$\Delta d = 0.06000 - 0.05774 = 0.00226 \text{ inch}$$
$$\Delta M = 0.00226\ (\csc 45 + 1) = 0.00546 \text{ inch}$$
$$M_2 = M_1 + 0.00546$$

This is an exact method of checking measurements for all symmetrical angular profiles with an even number of teeth.

Type II: Involute profiles have variable contact angles that change with variations in tooth thickness or pin diameter. When the change in pin diameter is small (0.0001 to 0.0020 inch) the change in contact angle is usually less than half a degree. If the pin contact angle can be found, the computation is similar to that for Type I conditions and the same formulas apply. The following equation can be used to determine the contact angle, which need not be interpolated beyond the nearest minute or hundredth of a degree:

$$\sec \varphi = \frac{M_1 - d_1}{D_b}$$

If an even-toothed external gear has a base diameter of 2.8191 inches and a measurement of 3.2050 inches over two 0.1720-inch diameter pins, what would be the measurement over two 0.1728-inch diameter pins?

$$\sec \varphi = \frac{3.2050 - 0.1720}{2.8191} = 1.0759$$
$$\varphi = 21° 39' = 21.65°$$
$$\csc \varphi = 2.710$$
$$\Delta d = 0.1728 - 0.1720 = 0.0008 \text{ inch}$$
$$\Delta M = 0.0008\ (2.710 + 1) = 0.00297 \text{ inch}$$
$$M_2 = 3.205 + 0.003 = 3.208 \text{ inches}$$

This procedure is a rapid and accurate check for conventional computation methods.

Type III: When the change in pin diameter is medium (0.002 to 0.020 inch) for involute profiles, both contact angles must be computed. To use the equations listed in the table for Type III conditions, the contact angle must not change by more than 3 deg. The mean contact angle is used to obtain the difference in measurement.

If an internal spline with an even number of teeth has a dimension of 1.7750 inches between 0.0900-inch diameter pins, *Fig.* 2, double check the value 1.7191 inches as the new measurement between two 0.1080-inch diameter pins. The base diameter is known to be 1.6238 inches. Since this is an internal spline, the formula for the secant of the contact angle would be:

$$\sec \varphi = \frac{M + d}{D_b}$$

Known values for measurements between pins and

Nomenclature

D = Pitch diameter, inch
D_b = Base diameter, inch
d_1 = Given measuring pin diameter, inch
d_2 = New measuring pin diameter, inch
Δd = Difference between pin diameters, inch
K = $(\varphi_2 + \varphi_1)/\varphi_E$
M_1 = Given measurement over or between two pins, inch
M_2 = New measurement over or between two pins, inch
ΔM = Change of measurement over or between two pins, inch
N = Number of teeth
s = Circular space width of an external gear, inch
Δt = Amount tooth width deviates from standard, inch
$\varphi, \varphi_1, \varphi_2$ = Angles of contact between pin and involute profile, deg
φ_E = Angle between pin tangencies and a common straight line (always slightly larger than the mean contact angle between two different size pins), deg
φ_M = Main pressure angle, deg

diameters of pins can be tabulated with computed values for the angles of contact:

Measurement (M) (inch)	Pin Diameter (d) (inch)	Contact Angle (φ) (deg)
Given 1.7750	0.0900	29.46
Calculated ..1.7191	0.1080	27.29
Difference ..0.0559 = ΔM	0.0180 = Δd	——

$$\text{Mean contact angle} = \frac{56.75}{2} = 28.37 \text{ deg}$$

$$\Delta M = 0.0180 \ (\csc 28.37 + 1) = 0.05588 \text{ inch}$$

Since this value agrees within 0.00002 inch of the tabulated difference, the calculated answer is proved correct.

Type IV: When the change of pin diameter is over 0.020 inch or when the difference in contact angles exceeds 3 deg, it is no longer sufficiently accurate to obtain the mean contact angle. Instead of dividing the sum of the angles by 2.000, a pure number, K, is used. This yields an angle φ_K, which is slightly larger than the mean contact angle.

Values for K are obtained from the curves of *Fig.* 3, which was prepared from the exact relations shown. These relations indicate that when the difference of the secants of the angles at the centers of the pins are divided by the difference of the related involute functions, csc φ_K results.

The chart of *Fig.* 3 is used by selecting the curve nearest in value to that of the larger contact angle value, following this curve to its intersection with the vertical line representing the smaller contact angle and tracing left from the intersection to read the value of K on the left-hand scale. The value thus obtained for K is divided into the sum of the contact angles to give the special angle φ_K.

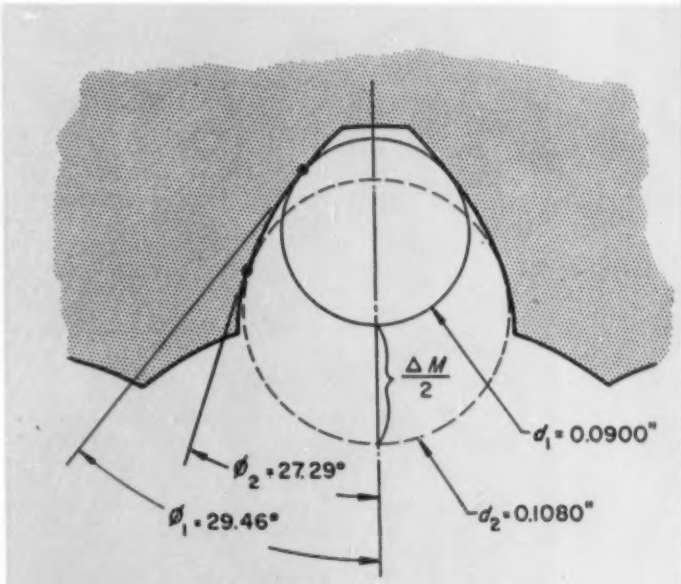

Fig. 2. Contact angles for two different sizes of pins with an internal spline.

If the chart is not sufficiently accurate for the required calculations, the following formula for chage in measurement can be used:

$$\Delta M = \Delta d \left(\frac{\Delta \sec \varphi}{\Delta \text{ inv } \varphi} + 1 \right) = \Delta d \ (\csc \varphi_E + 1)$$

Given a large external gear with an even number of teeth and a size of 6.9933 inches over two 0.3200-inch diameter pins, *Fig.* 4. The gear has a base diameter of 6.3442 inches. As a check on the profile during manufacture, a measurement of 8.2903 inches over two 0.7200-inch diameter pins is calculated. To check the 8.2903-inch measurement, the known data and computed contact angles can be tabulated:

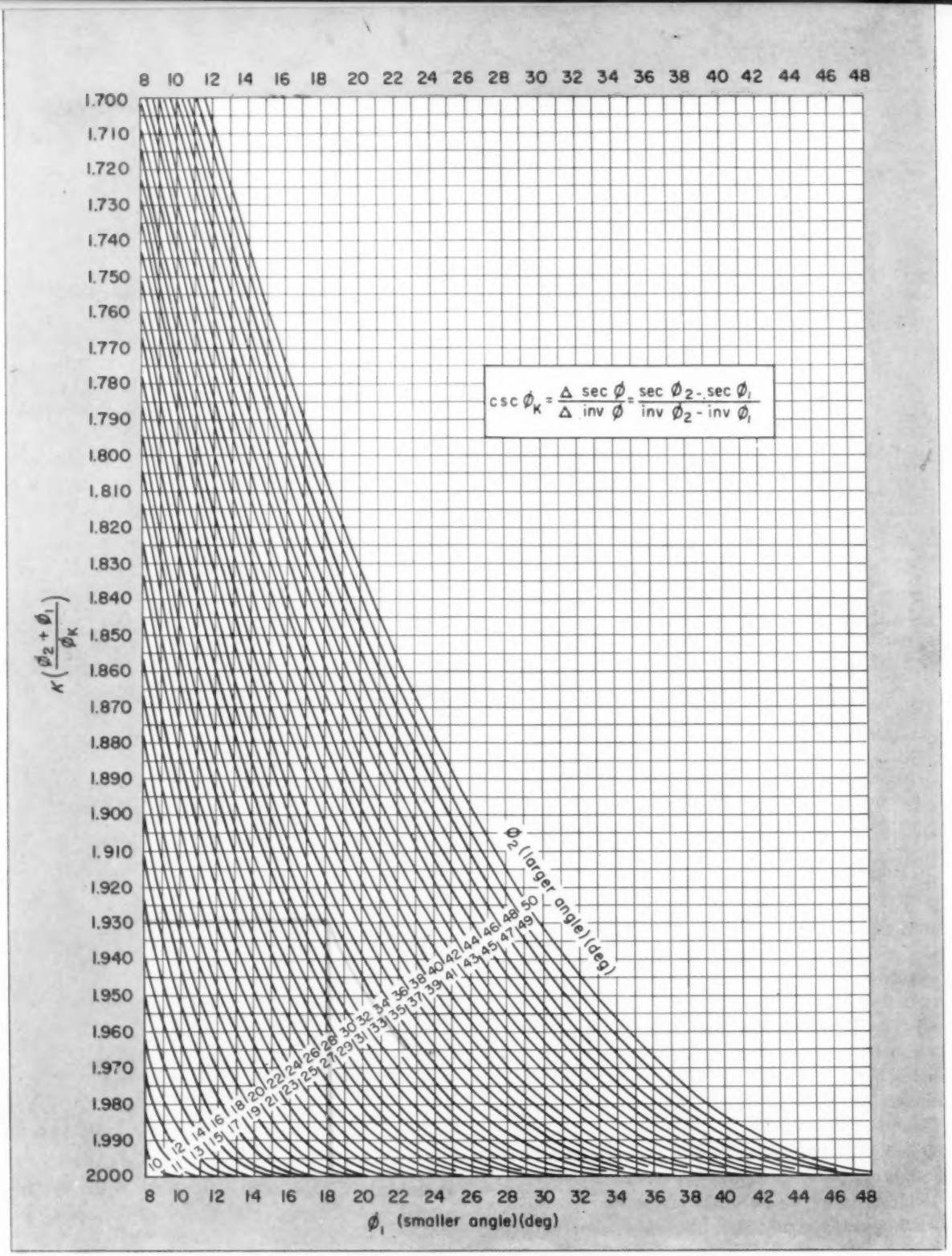

Fig. 3. Chart for obtaining values of *K*. Applies equally for internal and external involutes.

Measurement (*M*) (inch)	Pin Diameter (*d*) (inch)	Contact Angle (φ) (deg)
Given 6.9933	0.3200	18.07
Calculated 8.2903	0.7200	33.06
Difference ....1.2970 = ΔM	0.4000 = Δd	—

Using the chart in *Fig.* 3, following the example shown in color, a value for *K* of 1.931 is found.

$$\varphi_K = \frac{33.06 + 18.07}{1.931} = 26.48 \text{ deg}$$

$$\Delta M = \Delta d \text{ (csc } 26.48 + 1)$$
$$= 0.4000 \text{ (3.2427)} = 1.29708 \text{ inches}$$

Since this agrees within 0.00008 inch of the tabulated measurement difference, the calculated value of 8.2903 is correct.

The same problem can be checked mathematically if greater accuracy is necessary.

$$\csc \varphi_K = \frac{\sec \varphi_2 - \sec \varphi_1}{\text{inv } \varphi_2 - \text{inv } \varphi_1}$$

It tables of involutes are not available, the following formula can be used:

$$\text{inv } \varphi = \tan \varphi - \frac{\pi \varphi}{180} = \tan \varphi - \text{arc } \varphi$$

$$\csc \varphi_K = \frac{1.193264 - 1.051881}{0.073940 - 0.010890} = 2.2424$$

$$\Delta M = 0.4000\ (3.2424) = 1.29696 \text{ inches}$$

Since this value differs only 0.00004 inch from the tabulated difference, the calculated measurement of 8.2903 is correct.

Type V: When an original calculation for a measurement over or between pins must be made for involute gears or splines, it is usually easiest to select pin diameters for which tables based on standard tooth thicknesses are available [1,2]. If the gear is slightly larger or smaller than standard, a tabulated constant is used to determine the change in measurement, ΔM, according to the amount the tooth width deviates, Δt, from standard. This method, however, is not accurate when the change of tooth width exceeds 5 percent of the standard tooth width. Inaccuracy occurs because the pin moves to a new contact point, introducing a new contact angle, which changes the ratio between Δt and ΔM.

Calculation of pin measurements must often be made for nonstandard teeth with standard or nonstandard pin diameters. An extremely simple method[3,4], that requires neither involutometry tables nor interpolation, can be used to check such calculations. Also, the pin contact angle is always the same; equal to the main pressure angle[5]. The method can be used for either internal or external gears.

Basis of this method is the establishment of an intermediate or "stepping stone" measurement to help check, within 0.0001 inch, an original calculation over pins of a different size. Centers of the assumed pins are on the pitch circle, *Fig.* 5, and their diameters are equal to the product of the circular space width and the cosine of the main pressure angle. The measurement over such pins is equal to the sum of the pin and pitch diameters (their difference for internal gears). After the intermediate size has been determined, the remainder of the problem is calculated as in Type IV.

Representing an instance of nonstandard tooth thickness and nonstandard pin diameter, consider a 36-tooth, 4 diametral pitch, 20-deg pressure angle

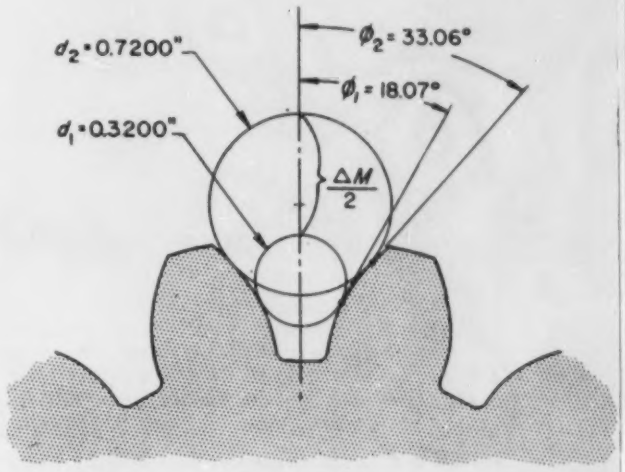

Fig. 4. Contact angles for two different sizes of pins with an external gear.

[1]References are tabulated at end of article.

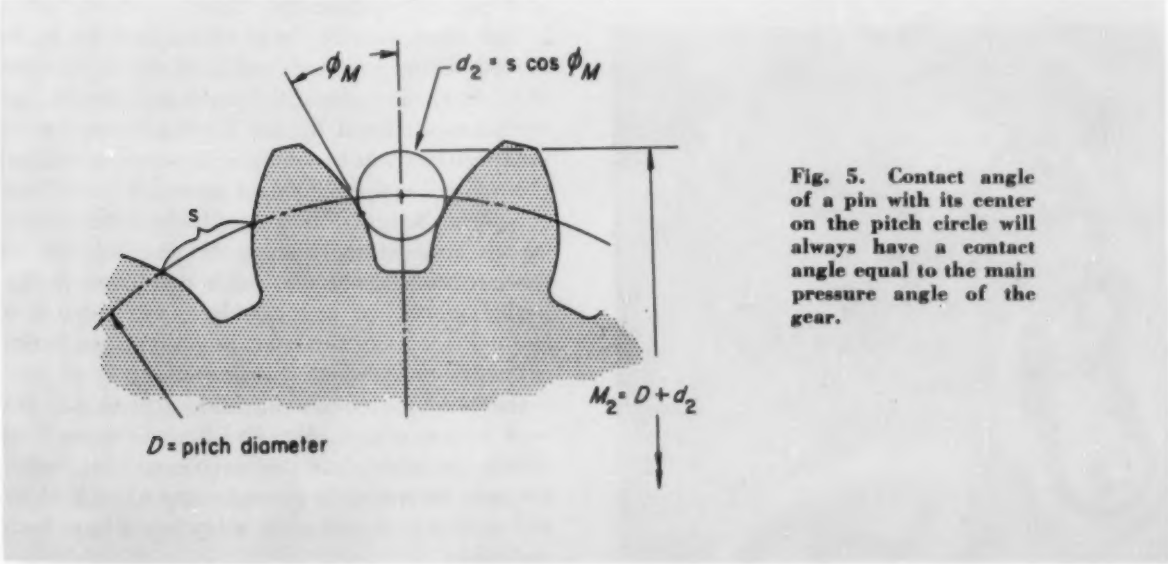

Fig. 5. Contact angle of a pin with its center on the pitch circle will always have a contact angle equal to the main pressure angle of the gear.

external gear with a 0.3327-inch tooth thickness. A measurement of 9.7022 inches over two 0.5000-inch diameter pins is calculated by conventional methods. The base diameter is 8.4572 inches. It is desired to check the 9.7022 value.

A stepping stone measurement is figured over special size pins. The circular space width is equal to the difference between the circular pitch and circular tooth width, or:

$s = 0.785398 - 0.3327 = 0.452698$ inches
$d_s = s \cos\varphi_M = 0.452698\ (0.9396926) = 0.425397$ inches
$M_s = D + d_s = 9.000000 + 0.425397 = 9.425397$ inches

Continuing with the tabular form:

	Measurement (M) (inch)	Pin Diameter (d) (inch)	Contact Angle (φ) (deg)
Calculated	9.7022	0.5000	23.21
Stepping stone	9.4254	0.4254	20.00
Difference	$0.2768 = \Delta M$	$0.0746 = \Delta d$	——

Adding contact angles and dividing by a value of K from the chart, *Fig.* 3:

$$\varphi_E = \frac{23.21 + 20.00}{1.996} = 21.65 \text{ deg}$$

$$\Delta M = \Delta d\ (\csc\varphi_E + 1) = 0.0746\ (\csc 21.65 + 1)$$
$$= 0.27681 \text{ inch}$$

Since this checks within 0.00001 inch of the tabulated measurement difference, the 9.7022 value is correct.

These simple checks are well worth the effort they require. The engineer who checks pin measurement calculations will know he is right. It is worth while knowing that his company will not produce scrap as a result of errors in calculations. This might save considerable in dollars and time.

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2. *American Standard Involute Splines ASA B5, 15-1950*—American Society of Mechanical Engineers, New York, N. Y.
3. Candee, Allan—"Involute Gear Calculations," *American Machinist*, March 15, 1928.
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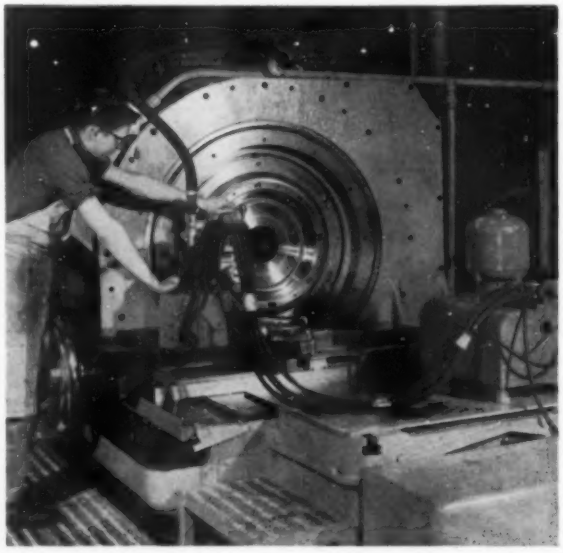
Converted Machine Tool Solves Tough Jet Job

CREATION of a contour finishing machine from an obsolete Wickes center drive crankshaft lathe has solved a difficult, expensive and lengthy machining job which grew out of need for precision machining of compressor disks used for the powerful J-57 jet engine. This engine has 16 compressor disks, each holding a specified number of blades. Such disks are critical and at one point the stainless steel narrows to ⅛ inch. Ordinary T-lathes had been used for the work with unsatisfactory consequences: disks had a tendency to "dish" if too much tool pressure was applied; processing time was high because each disk must be turned at least six times during finish contouring; and scrap was unavoidably but disproportionately high.



The same trouble faced Thompson Products, Pratt & Whitney Aircraft and Ford Aircraft Engine Div. At Ford, study of the problem indicated new equipment designed for the job would require approximately a year to complete: however, an adaptation of old equipment might serve. A production equipment designer, after completing a full design layout, stripped the obsolete Wickes lathe to its base, retaining only the center drive feature, installed new ways and carriages, incorporated a hydraulic tracing unit and built in proper ratios in the different feed mechanisms.

On the completed contour finishing machine, tools work opposite each other at all times preventing dishing or other distortion problems. Setup time has been decreased 75 percent, output has doubled and quality improved while scrap losses have been negligible.

developing tooling for gear production

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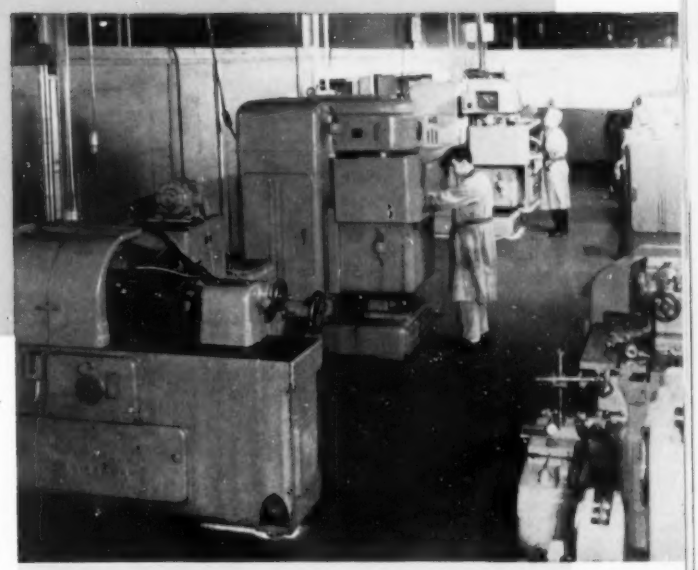

Fig. 1. Over-all view of Michigan Tool gear development laboratory showing some of the equipment used to modify tooling, develop manufacturing setups and prove-out designs.

MANY gear production problems are so complex that they require more than previous manufacturing experience for solution. This is particularly true when a variety of factors involving technical and economic problems are present. For instance, producing gears of a new design often involves sizable expenditures for new tooling and machines, so the production line is no place for experimental work. Once the decision is made as to how the job will be handled, second guessing is a luxury few companies can afford.

Whenever a gear is to be mated with another gear, or a complete gear train, questions frequently arise as to the best way to effect tooling setups or modifications, so that the mating gears will operate quietly and smoothly. Other questions involve what machines should be used for forming gears, what finishing method is best suited to the job, how many machines will be required to attain the desired production rate, how they can be arranged best in available manufacturing space, etc.

Usually gear engineering experience and knowledge supplies the necessary answers, but some of these answers require laboratory verification. In such cases, a gear laboratory, *Fig.* 1, can explore the more promising possibilities and come up with the answer in a short time.

Many unforeseen problems in gear production can thus be avoided or existing production problems can be cleared up. This method is particularly valuable where modifications in gear cutting or finishing tools are required, or where projected tooling setups on gear production machines must be analyzed. By concentrating a variety of equipment and technical skills in one location, it is possible to find the solution to many individual and unusual gear production problems.

A typical job will be followed through the laboratory to see what is done in a gear development program. The workpiece to be used in this case study is a 27-tooth helical gear shown being cut, shaved and checked for involute profile and correct lead, *Figs.* 2-5. It is a gear designed for a new transmission for which all gears are being developed simultaneously.

Among the problems to be worked out in the gear laboratory, is the amount of distortion result-

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ing from heat-treating the machined gear. Once this fact is established, corrective modifications can be provided in the tooling before the gear actually goes into production.

First, gear teeth are hobbed or shaped with standard tools. The gears produced are checked for involute, lead, spacing, etc., and the information is recorded. Following this step, the gears are finished with standard shaving cutters. Finish machined (green) gears are then checked to be certain that they meet the required tolerances, and this information is recorded.

The next step is to heat-treat the gear. After heat treatment, the gear development laboratory again checks the gear for distortion and records the findings.

Records on the gears before and after heat treatment are then turned over to the gear tool engineers, who make corrective modifications on the gear tool drawings. The shop then makes the necessary corrections in the tooling to compensate for distortions in heat treatment.

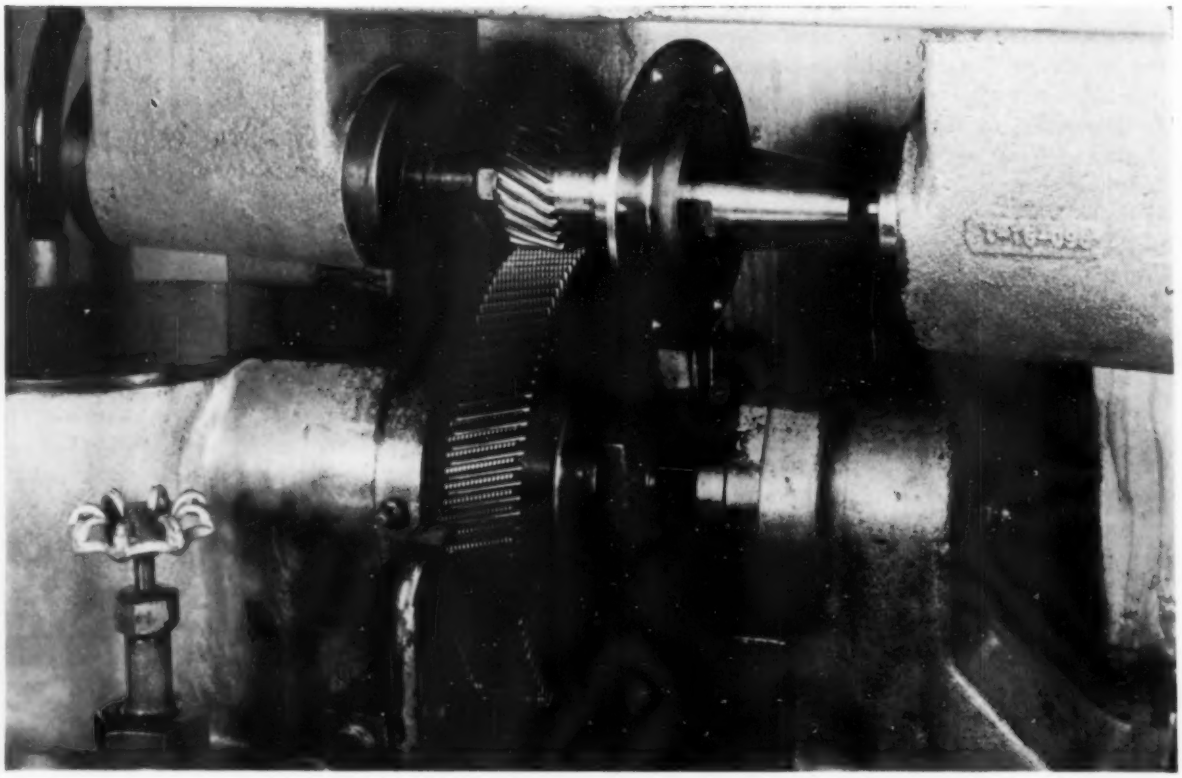
The gear development laboratory then cuts and finishes the gears with the modified tools, checks the gear and records the modifications on the gear produced by the corrected tooling.

Next step is heat-treating the modified gear and checking it to ascertain whether it meets the specified tolerances. Where the desired development is achieved on the first try, the drawings on the gear production tools are "frozen" and any hobs, shaper cutters, cutting tools, or shaving cutters for this particular gear are made to these tool prints.

Where the gear is not within required tolerances, modification of the gear tooling and production, and testing of sample gears are continued until the

Fig. 2. (left) Gear under development being cut on a gear shaper.

Fig. 3. (below) Shaving cutter being developed for new gear design. Factors such as possible heat treat distortion must be considered and compensated for in shaving cutter design.



required modification of the tools is determined.

Time lapse is so short between each operation in the development process that the time required for the development of the tooling is brief. Also, the number of experimental modifications or setups are materially reduced due to the close coordination between development and engineering groups.

Where changes in current gear production lines are desirable without interfering with production, use of the gear laboratory is ideal for development of tooling, setups and methods of reducing loading or unloading time with automation or mechanized operations. For instance, a company producing gears for a transmission may find that a 20 percent increase in production is required. The planning engineers calculate that by adding two gear cutting machines the necessary boost can be realized, except for the shaving operation on one gear. But if another shaving machine is added to this operation, only a portion of its capacity will be required.

This problem is submitted to the tool engineering department. Since the gear is being finished with conventional shaving, engineering suggests that this gear be finished by the underpass method, which is much faster. The problem is then turned over to the gear laboratory and an underpass cutter is developed that will turn out gears identical to those now produced by the conventional method. Should it be desirable, an underpass cutter can be developed to produce a crowned tooth. Since this method increases production, the need for an additional shaving machine is eliminated. When this development is completed, the change-over can be made on the gear shaving machine in the production line with hardly an interruption in schedules.

Supplementing the laboratory operating staff, is the combined experience of gear engineers who consult on new designs of complex gear assemblies such as transmissions. From the group effort, for example, come ideas to best utilize shaving cutters on finishing operations. Another suggestion might show an easy way out of a difficult operation, such as side trimming of clutch teeth to prevent slipping out of second gear. Again, they might suggest a suitable design to take advantage of an entirely new process such as spline rolling instead of some well-established method.

Problems channeled to a gear development laboratory for solution vary widely. Internal gears, external gears, spurs and helicals of fine, medium and coarse pitches, and gear steels that pose machinability problems, are typical examples. From experience it is found that a gear development laboratory with adequate equipment and a trained experienced staff, coordinating its efforts with engineering and shop, is the most efficient method yet devised to provide the solutions to gear production problems.

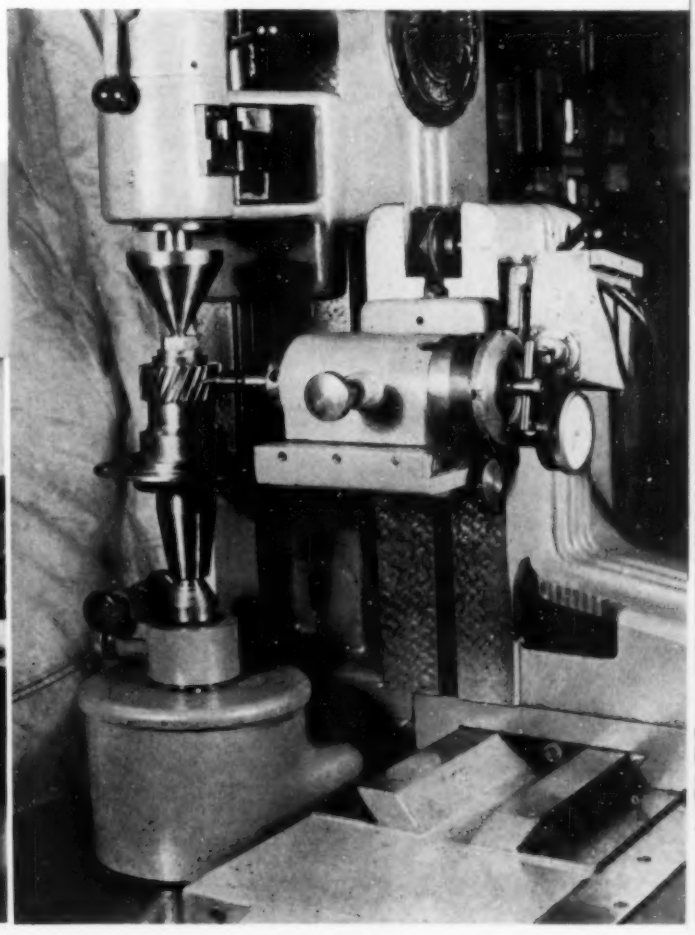
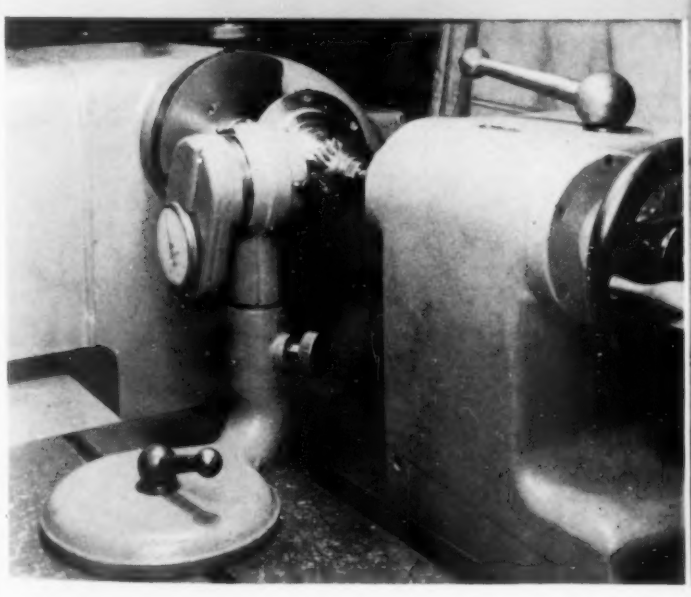
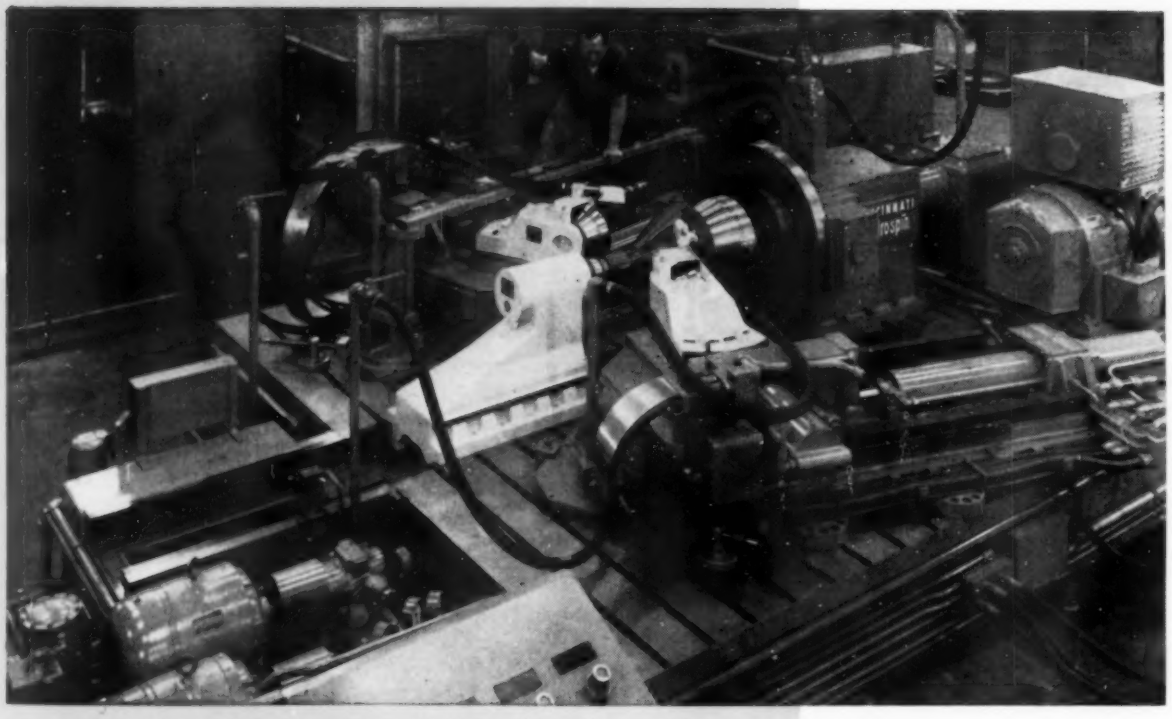


Fig. 4. (below) Checking lead on new gear design.

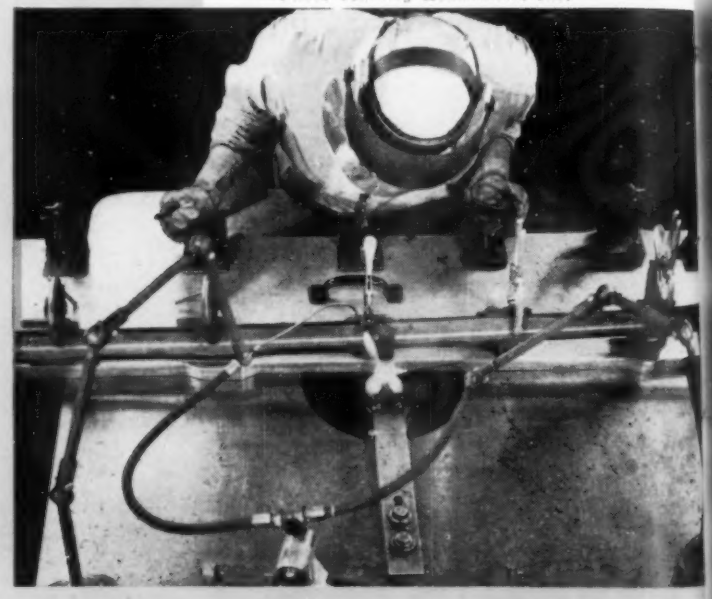
Fig. 5. (right) Involute on same gear being checked in the gear development laboratory.





SPINNING a turbine shaft for a jet engine is performed on semiautomatic equipment at GE's Evendale, Ohio plant. This machine was developed jointly by the producer and Cincinnati Milling Machine Co. to cold roll hollow conical and tubular-shaped pieces. Parts produced are cheaper as well as stronger, more fatigue resistant and harder than if made by other methods.

—Photo courtesy Kennametal Inc.



INGENIOUS TOOLING permits fast profiling of closure ribs for large aircraft wing. A spindle shaper was adapted to machining the SAE 4340 steel workpiece by use of a carbide-tipped, three-flute special end mill. The material, heat-treated to 40-42 R_c, and $\frac{3}{32}$ to $\frac{1}{2}$-inch thickness, is contoured at 2062 sfpm. The ribs are clamped to an aluminum fixture, the edge of which serves as a template and rides on a bushing mounted on the cutter shank. Coolant is CO_2. Roughing and finishing cuts are required. Floor-to-floor time is cut 96 percent over conventional profiling.

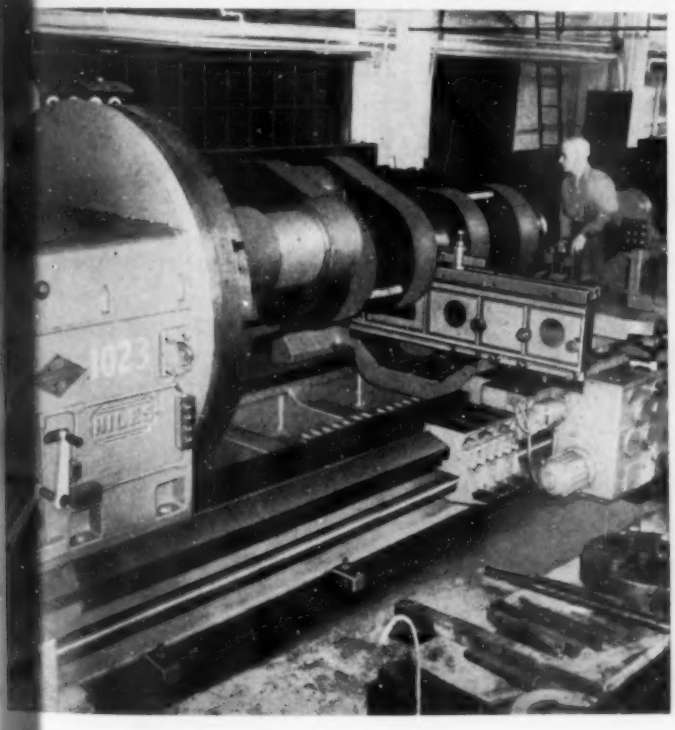
TOOLS at work

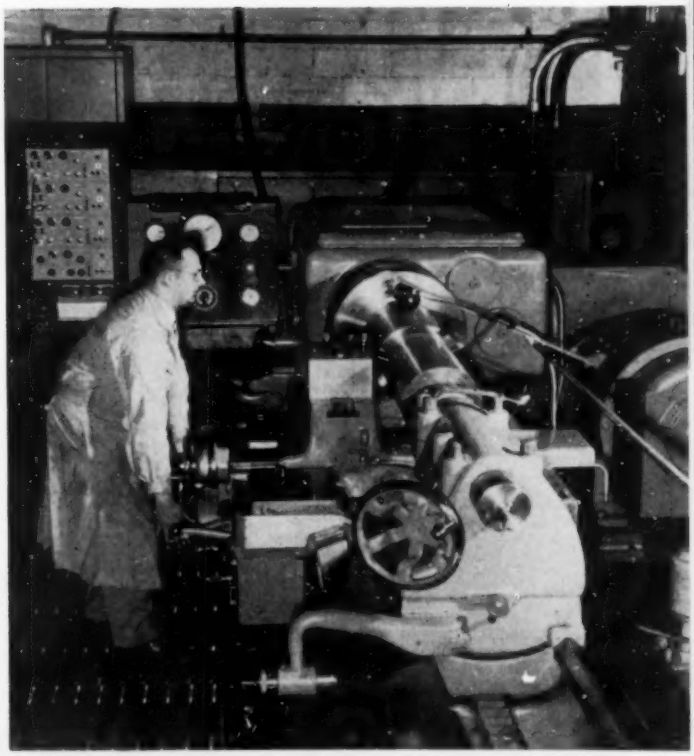
STRAIGHTENING stainless steel tubing is simplified at Helical Tube Corp., Grand Rapids, Mich. by means of rotary straightener. Cold drawn or welded tubing of $\frac{1}{8}$ to $\frac{7}{16}$-inch OD is brought within tolerance of 0.060 inch per 3-ft. deviation in one pass. Lubricant is applied as the tubing enters the machine and removed as it leaves. Tube surface is unmarked as guides have been eliminated.

—Photo courtesy Mackintosh-Hemphill Co.

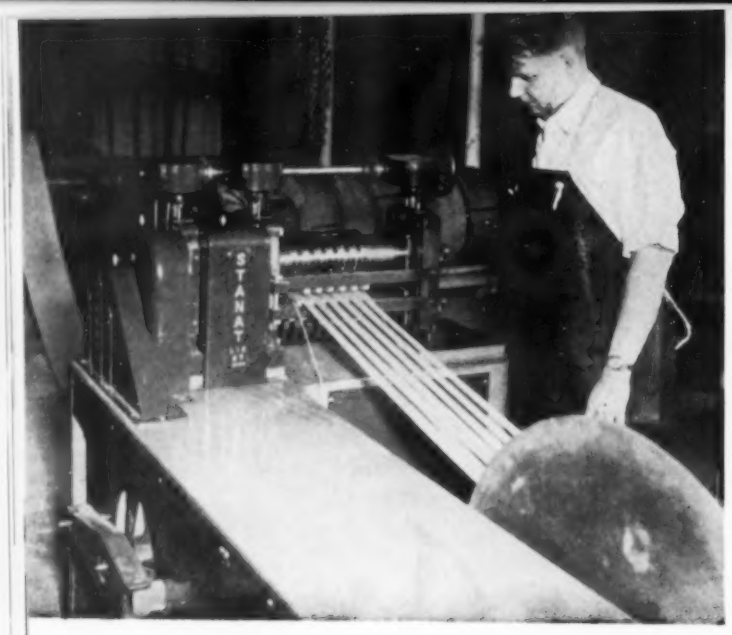
TURNING marine diesel crankshaft is accomplished in 90-inch lathe in Maryland Drydock Co. repair shop. A removable filler slide plate in the carriage bridge provides the extra swing clearance needed for the large crank throws. The special cross-feed turning bar, fitted directly to the tool rest, forms a solid extension for the tool. This allows the operator to machine the main journals with only two tool settings. Tolerance accuracy of the operation is plus or minus 0.002 inch.

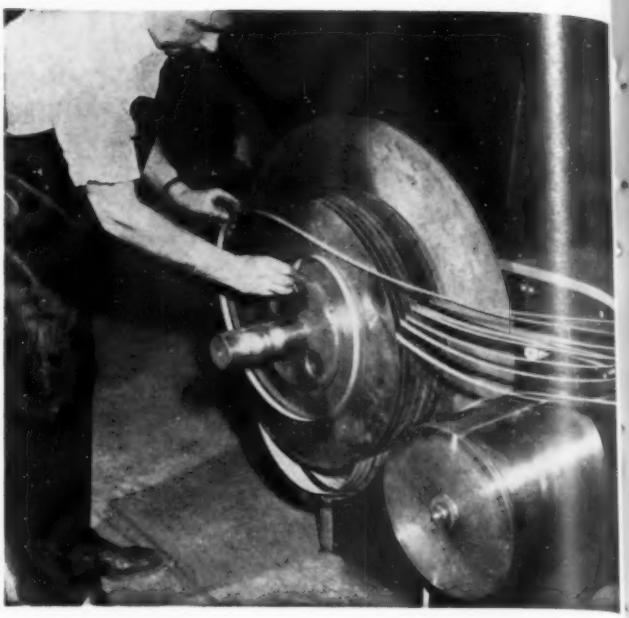
—Photo courtesy Baldwin-Lima-Hamilton Corp.



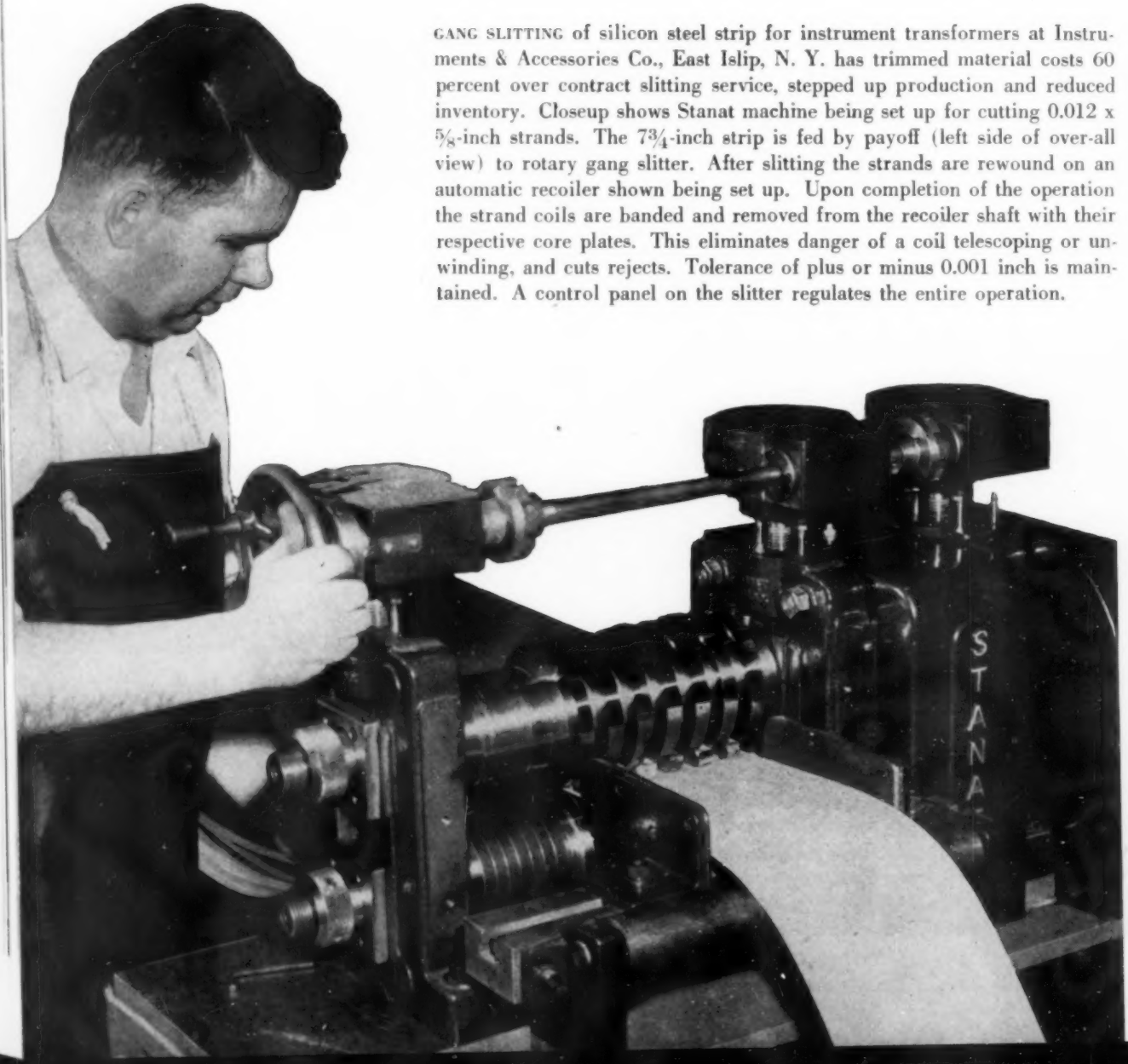


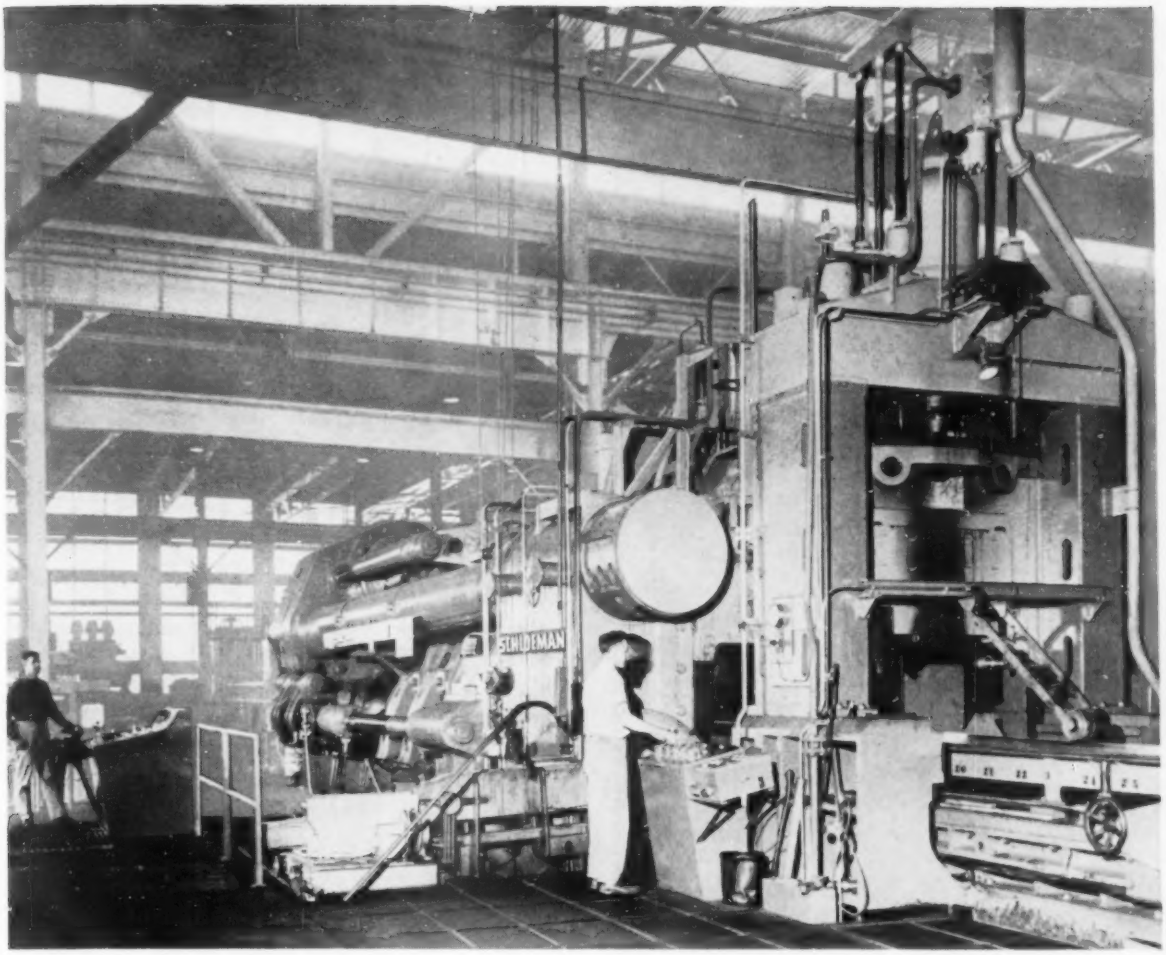
MACHINABILITY and cutting research are being expedited by special LeBlond lathe designed for heavy cuts at high speed. Installed in the Carboloy machinability laboratory, the lathe provides 75 to 140 hp at infinitely variable speeds from 4 to 1400 rpm. Speed is maintained by electronic feed-back. Instrumentation includes a work-riding tachometer for continuous reading of surface speeds on a three-range instrument.





GANG SLITTING of silicon steel strip for instrument transformers at Instruments & Accessories Co., East Islip, N. Y. has trimmed material costs 60 percent over contract slitting service, stepped up production and reduced inventory. Closeup shows Stanat machine being set up for cutting 0.012 x 5/8-inch strands. The 7 3/4-inch strip is fed by payoff (left side of over-all view) to rotary gang slitter. After slitting the strands are rewound on an automatic recoiler shown being set up. Upon completion of the operation the strand coils are banded and removed from the recoiler shaft with their respective core plates. This eliminates danger of a coil telescoping or unwinding, and cuts rejects. Tolerance of plus or minus 0.001 inch is maintained. A control panel on the slitter regulates the entire operation.

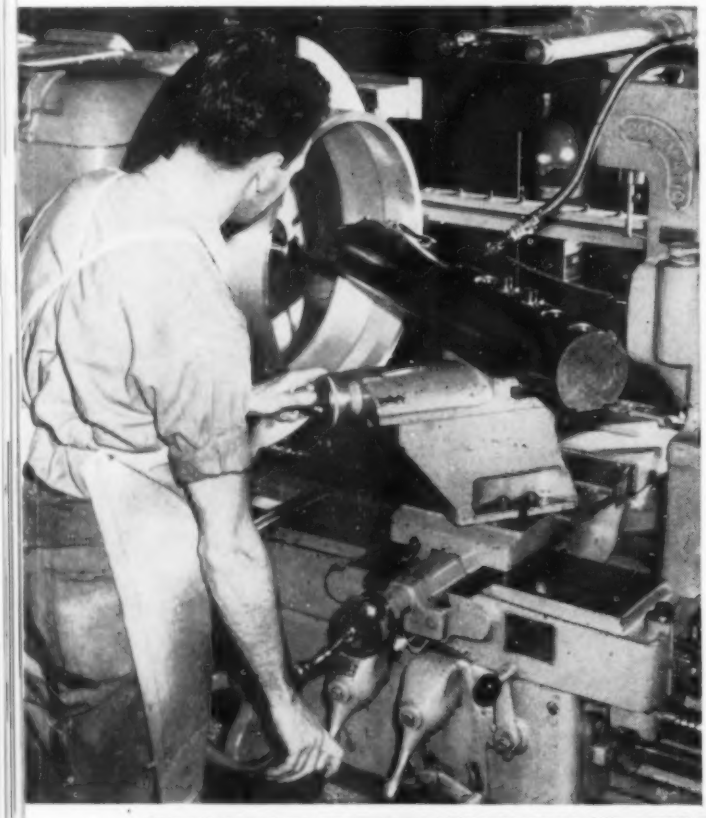




HEAVY PRESS PROGRAM of USAF nears fruition in one phase from experience gained with 14,000-ton extrusion press at Alcoa plant in West Lafayette, Ind. Rated the world's largest at time of installation, the press is now in operation to provide special extrusion shapes required for high-speed aircraft. Electric and hydraulic controls in two pulpits make possible semiautomatic operation.

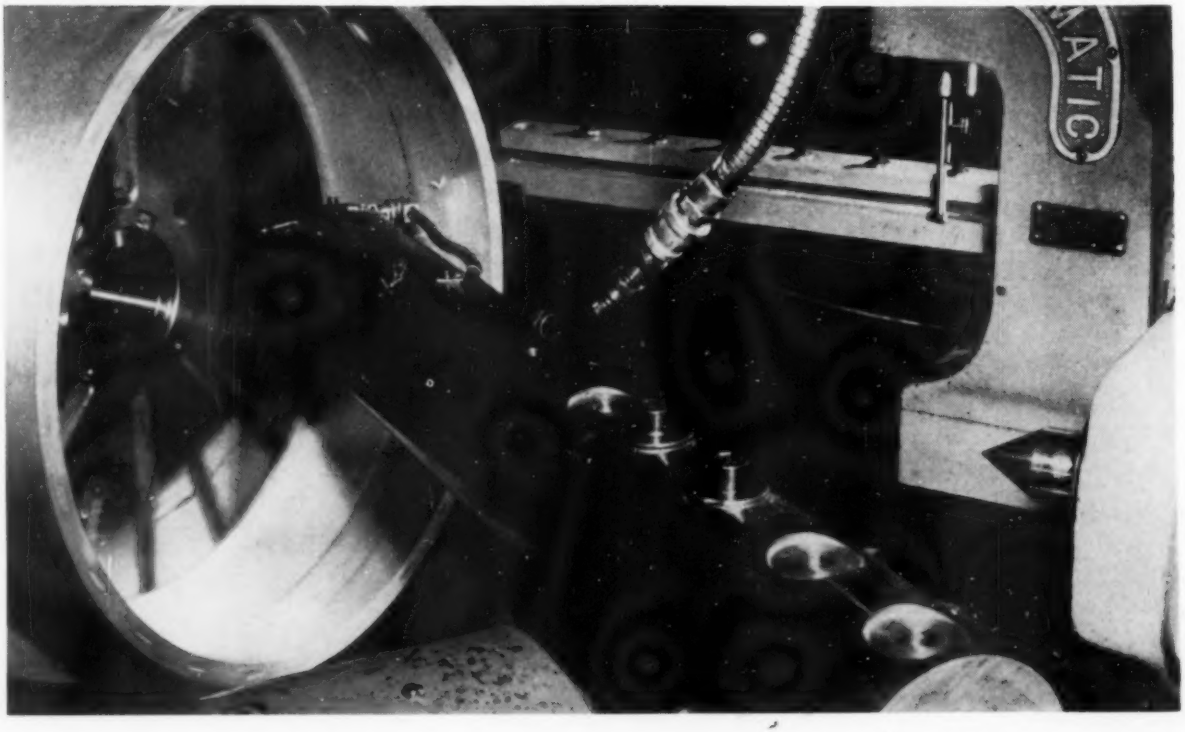
TOOLS at work

TOOLS at work



INTERNAL RADIUS of differential housing is bored in tracer-controlled lathe at Fairchild Engine Division, Farmingdale, L. I. The workpiece is aluminum, with a diameter of 21 inches and length of 6½ inches. Although the lathe's nominal capacity is 20 inches, the headstock, compound rest and tailstock are raised to allow a 30-inch swing capacity for this size workpiece. A tungsten high-speed steel tool is used at a cutting speed of 230 sfpm and a feed of 0.020 ipr. As shown in the closeup the stylus is tracing from a flat template. The operation is accomplished in half the time required previously for other methods.

—Photos courtesy Lodge & Shipley Co.



draw punch failure

solves production puzzle

By Hubert J. Pessl

Director of Shell Engineering Research
Gibson Refrigerator Co.
Greenville, Mich.

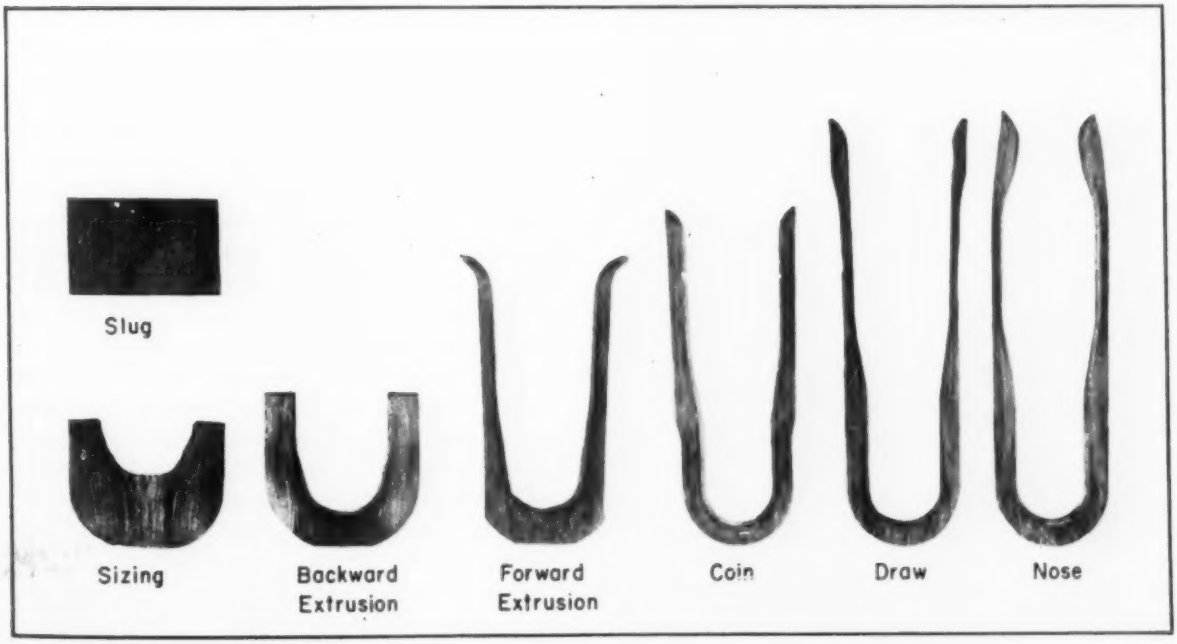
COLD FORMING of 75 mm shells involves a critical drawing operation in addition to two cold extrusion steps. The process has been highly successful with over a million such parts produced to date by the Defense Products Division. The sequence of cold forming operations, as well as the metal flow resulting, is illustrated in *Fig.* 1. Material used is C1018 fully aluminum killed steel.

One of the problems encountered in connection with the drawing operation was fracturing of workpieces, which occurred on several occasions, *Fig.* 2. Process anneals of 1200 F are used only after the sizing operation and after backward extrusion. The shell has a hardness of from 75 to 85 R_b after forward extruding and coining. Therefore, drawing the workpiece at this hardness with over 40 percent reduction in cross section, in order to obtain the required yield strength of 85,000 psi minimum, constitutes a severe cold forming operation.

However, success with the process has been so marked that when the fractures began to appear it was felt they must be due to an extraneous condition which had been introduced. These draw failures all had the characteristics of tension test fractures indicating that the ultimate tensile strength of the material was exceeded during drawing.

When no single cause for these breakages could be established, it was felt that they had to be attributed to combinations of possible contributory factors, such as defective bar steel or faulty heat treatment, surface treatment or tooling. After installation of a new draw punch no breakages occurred during a production period of about 25,000 shells. Then draw fractures started at irregular intervals but increasing in numbers. A tooling check

Fig. 1. Deep-etched sections of successive steps performed in cold forming 75 mm shell.



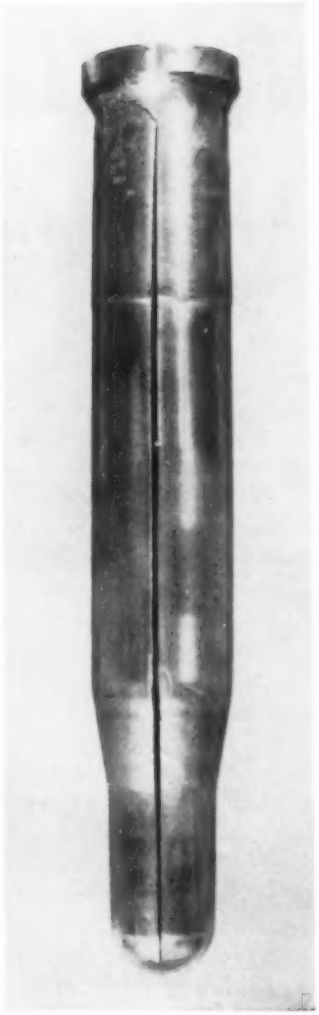


Fig. 2. (top left) Piece-part of 75 mm shell fractured in drawing operation.

Fig. 3. (top right) Draw punch fractured after 100,000 parts were produced.

Fig. 4. (bottom) Etched sections of fractured draw punch. "Flake" is apparent near centers of sections.

made at that time failed to indicate any dimensional changes of the draw punch.

Finally the scrap losses due to draw fractures approached 6 percent of production. Drawing and nosing operations were temporarily discontinued and stress relief annealing of the forward extruded parts was contemplated as a possible remedy to stop the breakage.

When the first shell was drawn on the next day, however, the draw punch split lengthwise as shown in *Fig.* 3. Fitting the two halves of the broken punch together results in a gap ⅛ inch wide, indicating the magnitude of the locked-in stresses which were relieved by the breaking of the punch.

From the photograph of the punch sections. *Fig.* 4, it can clearly be seen that the punch fracture originated from a "flake," generally thought to be caused by hydrogen occulsion or hardening stresses. The lens-shaped rupture of the flake, which is located almost in the center of the punch, gradually developed into a typical fatigue fracture. During the period just prior to its breakage the diameter of the punch must have increased continuously, especially in a plane normal to the plane of fracturing. The reduction of cross section during the drawing operation was, thereby, steadily increased which in turn resulted in the growing percentage of draw failures.

The punch was made of high carbon-high chromium nickel alloyed deep hardening tool steel of the following approximate composition, percent:

C	Mn	Ni	Cr	Mo	V
0.85	0.40	0.10	11.50	0.50	0.30

Although not definitely known, it can be assumed that the punch was oil quenched from 1850 F and drawn at 300 to 400 F to a hardness of 60-61 R_c.

While over 100,000 shells were drawn with this punch up to the time it broke, more than double that life could be expected under normal conditions. It would seem that a close dimensional check of the punch prior to its complete failure should have revealed an increase of the diameter in a plane normal to that of the fracture. Certainly an X-ray or ultrasonic examination of the punch during the last stages of its performance should have been able to detect the internal rupture.

At any rate, in case of an occurrence of draw breakages of the previously mentioned kind, a change of punches would be advisable if no immediate cause could be determined.

matched metal dies

for fiberglass reinforced plastic parts

By Robert S. Morrison
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and
Morgan Martin*
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Ashtabula, Ohio

MATCHED METAL DIES for press molding fiberglass reinforced plastic parts are similar in many ways to dies used for drawing metals and molding nonmetallic materials but are different in one important respect. In the fiberglass reinforced plastic molding operation two dissimilar materials are used—glass fibers and a liquid thermosetting resin, usually polyester. Discussion of dies for such use will be confined to those for molding fiberglass mat or preform reinforced plastics, *Fig.* 1.

In all other types of molding or material forming, a single homogeneous material is handled by the dies. In such operations, the homogeneity of the material is maintained as it stretches or flows. Since two distinct materials are used in producing mat or preform reinforced plastics, the dies must form and hold the fiberglass reinforcement while the pressure exerted by the dies causes the liquid resin to flow through and completely impregnate the fibrous material. To secure the proper proportion of resin-to-fiberglass at all points in the molded part, the fiberglass must not flow with the resin.

Another big difference between ordinary and reinforced plastic molding is in the relative resistance of the resin to flow. In molding other thermosetting materials, thermoplastics, rubber, or die-casting metals, pressures from 1000 to 2000 psi are usually required to fill out the cavity. Such materials can readily be contained by the moderate restrictions that maintain pressure during molding. However, polyester resins at room temperature have an average consistency equal to that of a heavy oil. When heated, they thin out rapidly prior to gelation, *Fig.* 2, and the bulk modulus of elasticity is so high that it contributes no back pressure.

Molding dies must be carefully constructed to contain the resin in order to maintain the pressure exerted by the press and by the thermal expansion of the resin. If this is not done, one of the components, monomeric styrene, in the resin may volatilize, causing pits. The resin must be constrained under pressure to control its flow through the fibrous material and to drive out all of the air originally contained by the mat or preform. If air remains in the mat, dry fiberglass spots will be present in the molded part.

Properly constructed matched metal dies telescope within each other to place the resin under pressure in the same way that fluid is compressed by the piston in a hydraulic cylinder. These telescoping "pinchoff" edges must be fitted closely so that little or no resin can escape during the molding operation. Clearance of about 0.002 inch is maintained with a telescoping distance of from $\frac{1}{16}$ to $\frac{1}{8}$ inch. *Fig.* 3 shows the cross section of a simple mold illustrating a telescoping pinchoff.

Matched metal dies should be made of flame-

*Senior member ASTE Ashtabula County chapter.

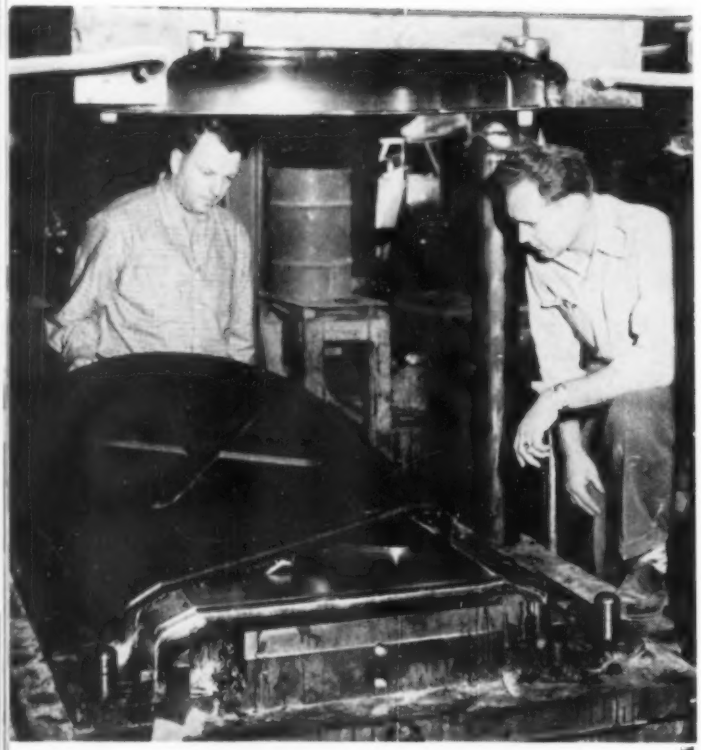

Fig. 1. Spare tire carrier made of fiberglass reinforced plastic on matched metal dies.

hardenable steel wherever possible or should be a flame-hardenable alloy cast iron. Steel castings have not given good results. Cast steel shrinks about $\frac{1}{4}$ inch per foot as compared to $\frac{1}{8}$ inch or less for cast iron. This greater shrink causes porosity which cannot be tolerated in dies heated by steam.

High-carbon steel plate is only slightly more expensive than mild steel plate and will flame-harden. For easy machining, this material should be normalized after it is torch-cut from a larger plate. Successful dies have been made of steel plate as thick as 10 inches but a casting is preferable if the molded part has a depth greater than 6 inches. Since both high-carbon steel plate and alloy iron castings will flame-harden, separate tool-steel pinch-off inserts are not required. Dies would have to be machined even more carefully to hold inserts and since the inserts also would need to be machined, cost of the pinchoffs would be doubled. Hundreds of thousands of parts have been molded in a set of dies without sufficient wear on the pinch-off to render the dies unusable. Since most fiberglass reinforced plastic parts are required in quantities between 1,000 and 100,000, dies will usually outlast the demand for the part.

During the flame hardening operation, sufficient care should be taken so that the hardness of the pinchoffs is not raised to the point of brittleness. A temperature of 1450 to 1500 F gives good results. A temperature of 1600 F will result in brittle pinchoffs, especially with castings.

Most dies now made of steel plate are mounted on heated press platens and are not cored for steam. Sometimes deep dies made of steel plate are cross-drilled to form steam cores. On small dies the drill size is equivalent to $\frac{1}{2}$-inch pipe, or $\frac{47}{64}$ inch. Steam line holes have been drilled $\frac{15}{16}$ inch in diameter for $\frac{3}{4}$-inch pipe and $1\frac{3}{16}$ inch in diameter for 1-inch pipe. On some deep dies made from steel plate, heating chambers are milled in the back and covered with a gasketed backup plate, *Fig.* 4. In cast dies, cores are placed in the sand mold to form heating chambers that can be covered with similar gasketed backup plates.

In molding parts of fiberglass mat or preform reinforced polyester resin, a pressure of 100 to 150 psi on the molded surface is usually adequate. Molding temperatures average between 220 and 250 F, depending on the size of part and the flow needed for the resin. With this molding pressure, light die sections can be used. A wall section of 1 inch between molding surface and steam core is adequate in dies machined from steel plate if supported on 6 to 8-inch centers. Cast dies are made with a wall thickness of $1\frac{1}{2}$ to 2 inches, plus finish, depending on the strength provided by the shape of the mold.

Knockout pins cannot be used with polyester resin since the resin will get behind the pins and make them inoperable. The only successful means of helping to remove a deep part is to have a small air line brought into the center of the part. The port should be covered by a seated valve that can raise enough to permit air to enter. This valve must be completely covered with cellulose tape before each molding operation so no resin can get into the valve. As air is introduced slowly and at low pressure, to prevent breaking the hot part, release from the mold is achieved. However, such air blowouts are seldom needed in production operations.

Except for a slightly raised pattern formed by the glass fibers, the resin will duplicate the surface of the die. Consequently, both dies should have a smooth surface. A 240 emery cloth finish is satisfactory, after all tool marks and ripples have been removed, for dies used to produce most pigmented parts. For part surfaces that are to be painted, an overlay mat is used that hides most of the fiber pattern. Surfaces are sanded to take off the shine prior to painting, which results in better adhesion.

Ripples and variations are especially undesirable in the surfaces of dies for painted parts. A high polish is not needed on dies, since a condition known as "laking" usually occurs during the molding operation. Between gelation and final cure, the resin shrinks. For some reason, it will shrink away from one die in some areas and the other die in other areas. Since dies seat against stops to control the desired thickness, this slight shrinking away

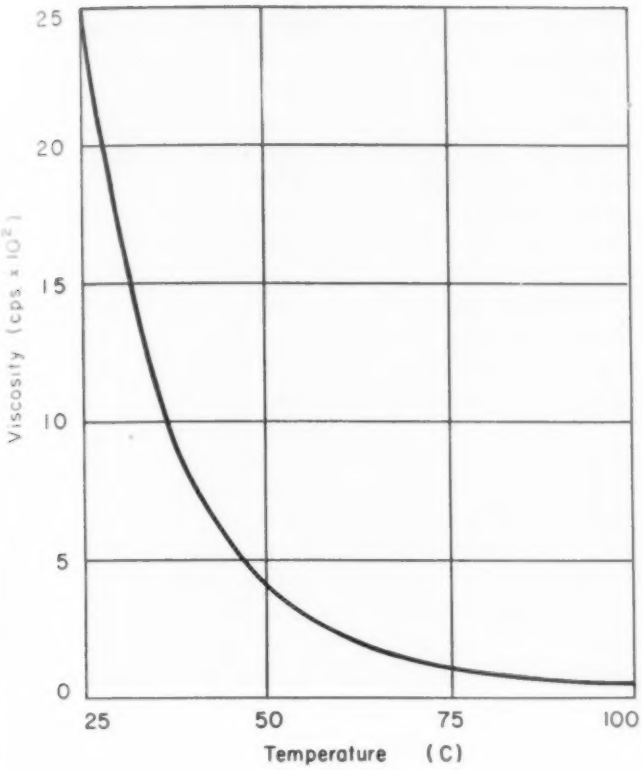

Fig. 2. Chart showing changes in viscosity with changes of temperature for a typical polyester resin.

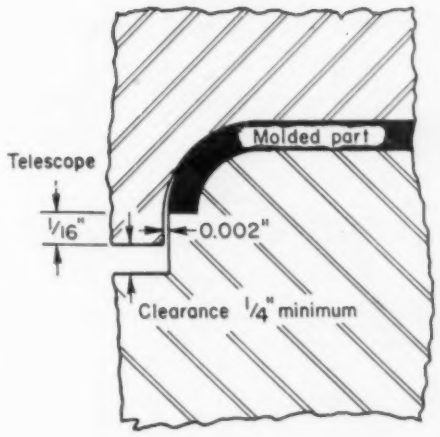

Fig. 3. Telescoping effect of pinchoffs on matched metal dies for reinforced plastics.

can occur. Where the resin has shrunk away from the die surface, a duller finish occurs than where the resin has cured against a die surface. The prominence of these "lakes" is heightened by shiny dies. In large flat areas where such an appearance could be quite noticeable, dies are usually finished to a satin rather than shiny finish.

Four guide pins and bushings should be used in each set of dies to insure that dies register properly when closing. When possible, dies should be designed so the hold-down holes fit the drilled and tapped holes in the press platens. Plain platens are desirable because T-slots reduce the effective thickness of a platen and increase deflection. Sometimes toe-clamps are used but direct bolting through the dies is better. Some 48 by 96-inch flat sheet dies are being designed for dowelling and bolting from the back to minimize deflection. These will be used on presses with heated platens. With deeper dies, deflection is much less a problem due to the beam strength of the dies.

Most dies made for automotive components require Keller models. A mahogany or plastic male model is made to the outside dimensions of the part. This model is set up with the pinchoff line already established. Metal templates are used to make sure the model corresponds with the drawing. As soon as possible after the male model has been approved a plastic or plaster female Keller model is taken from it. Matching male templates are made from the female templates to check the accuracy of the female model. The templates are necessary because models can change dimensions with changes in humidity and temperature. If castings are to be made, the pattern maker uses the female Keller model to make up a male pattern and from that a female pattern.

Since tolerance on contour dimensions is frequently greater than on part thickness, it is usually advantageous to make the male Keller model from the finished female die using a layup of sheet wax equal to material thickness. However, if urgency requires that both male and female dies be machined simultaneously, the male model is made from the female model and all contours must be held within wall-thickness tolerance.

More trouble is experienced with control of section thickness in dies that are made on Kellers than those made on straight milling and shaping equipment. This is to be expected since the removal of Keller tool marks is a hand operation. The die barber may grind or file slightly more stock off one place than another. The toolmaker keeps on the minus side for stock thickness until the dies have been tried out in a press because it is much easier to remove metal than it is to put it back on. This is especially true with castings. Since alloy iron castings are used, welding is difficult and may cause cracking. Even on steel dies the welded surface usually takes on a different appearance than the regular surface.

Some large cast dies have been built up with metal spray but this should be a last resort. Adhe-

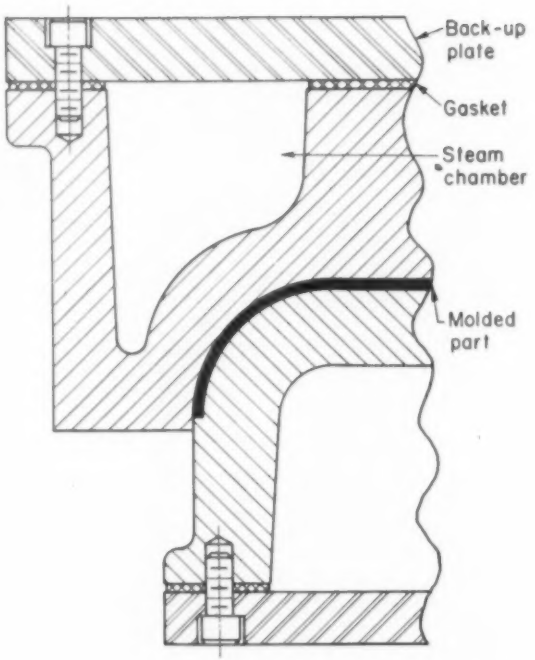

Fig. 4. Diagram of typical dies showing gasketed backup plate and heating steam chambers cored into the castings.

sion of metal spray, even with a special ground coat, is not good and the surface is not as dense as the base material. Consequently, this shows on the molded part and causes scumming of the dies.

A properly equipped toolmaker should have a hydraulic press to try out dies before delivery to production. Most toolmakers use wire solder to determine material thickness. Some actually pour a thin plaster. Since the thin plaster breaks up easily and is not a permanent record of material thickness, toolmakers should check material thickness by molding a fiberglass reinforced plastic part in the dies. This part can be cut into cross sections and marked for thickness. It can also be stock-drilled with a drill that will penetrate to just the desired thickness. The stock-drill makes slight dimples in the metal to indicate how deep it should be ground to achieve the required part thickness.

With large dies, the molder should work closely with the toolmaker and final fitting should be done on the press. Dies are usually not flame-hardened until after final fitting. Control of material thickness is most important because fiberglass will not flow and the resin will. Thus, a tight spot in the dies will create a white spot in the molded part which indicates an excessive amount of fiberglass and too little resin. A thick spot in the dies will result in too much resin, which may cause shrink crazing due to lack of sufficient reinforcement.

There are certain limitations in die and part design that go hand-in-hand. All parts must have draft and no undercuts or returns can be molded. Because of difficulty in locating the fiberglass reinforcement accurately, parts with different wall thicknesses should be avoided wherever possible. No postforming can be done after molding. Sharp corners of any type should be avoided to prevent resin-rich, weak corners. Vertical pinchoffs do not hold resin properly and also drag the glass fibers out of place during the telescoping of the dies. Parting lines should be as horizontal as possible. Frequently, to avoid vertical pinchoffs, a part can be molded double and cut in half or an extra section can be molded, which is later removed.

Due to resin shrinkage, die cleaning problems, etc., inside holes should not be molded unless punching after molding is difficult or impossible. Inside holes should be designed so vertical punching is practical. Edges of the molded piece will be either horizontal or vertical to the die plane because of the telescoping pinchoff. This means that a contoured part, such as a car rear deck, may not have its edge normal to the surface of the part and may require some hand grinding after molding. This is especially true if an inner and outer deck are matched together.

Changes in direction of flanges create a condition where the telescoping pinchoff must be reversed. It is difficult to attain proper sealing and fitting of the dies at the point of reversal. Reverse pinchoffs should be avoided wherever possible. Bulk of fiberglass mats or preforms, which are about five times as thick as the final molded part, tends to cause wrinkles in parts having little draft. This can be partially overcome by placing the male die on the lower platen and putting the preform on it. Then, the female die tends to iron out, rather than drag down the glass.

Another limitation on the use of matched metal dies is, of course, the time required to produce them. This time will be from four weeks to eight months depending on the size and complexity of the dies, and on availability of the particular machine tools needed to produce them.

The false economy of cheap simple dies for manufacturing fiberglass reinforced plastic parts has resulted in production of many poor parts and has probably ruined more potentially good applications for fiberglass reinforced plastic than any other single factor. Dies costing only a few hundred dollars will not produce quality parts at a low price. Production costs with poor tooling will run from 100 to 300 percent more than when proper matched metal die tooling and hydraulic presses are used. Much effort has been expended toward trying to eliminate the costly processes of carving metal on a Keller or mill and then hand barbering. So far, nothing has taken the place of proper machining of strong, homogeneous, flame-hardenable materials.

mechanizing press operations

IN A SMALL PLANT

By Attila DeIlly*

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Master Rule Mfg. Co., Inc.
Middletown, N. Y.

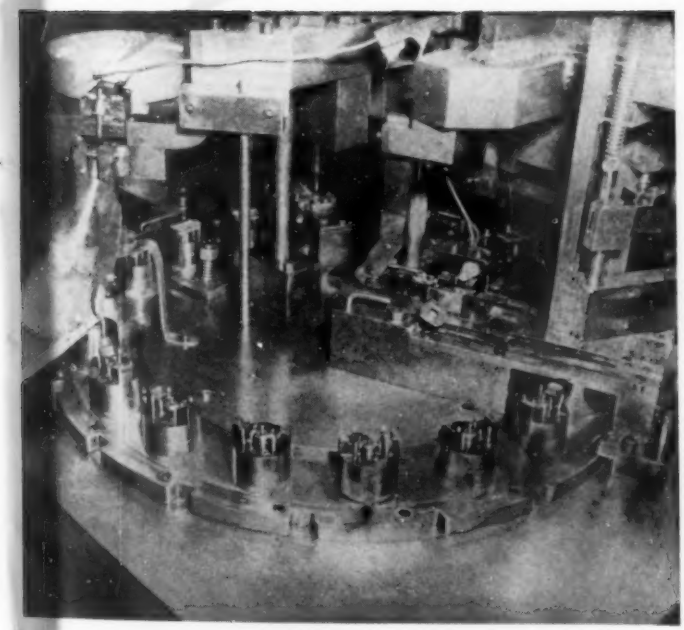


Fig. 1. Sequence of mechanized press operations is apparent in this closeup of 18-station dial feed on front of press, from spring feed magazine at right to solenoid operator unloader at left. The unloader "kicks" completed clamps into plastic chute. Details of progressive forming halves are shown in *Fig.* 2.

DEVELOPMENT of a high production setup in which two presses do more than three times the work of 14 machines, demonstrates how a comparatively small company can apply automatic techniques, *Fig.* 1, to boost output and lower unit costs. As manufacturers of wooden folding rules, the company has faced the need in recent years to rapidly expand production. This was an outgrowth of the booming "do-it-yourself" market in carpentry and home repairs. How to best meet production demands was the question.

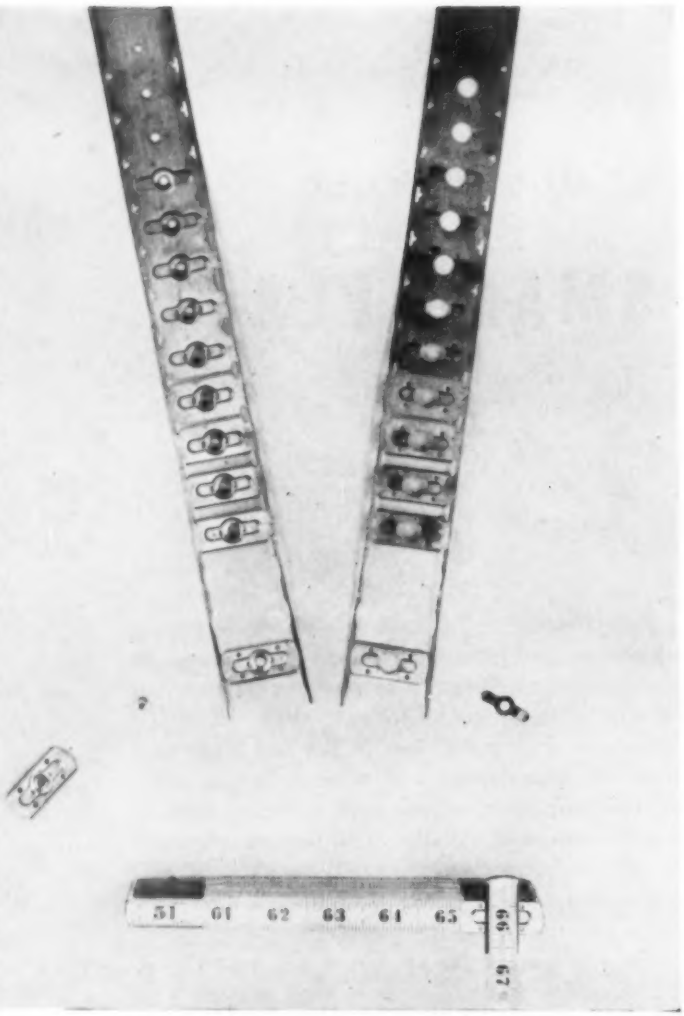
The vital part of the product is the metal clamp, *Fig.* 2, which acts as a joint at each section. This assembly consists of a stainless steel spring, two clamp halves (male and female) and an eyelet which serves as the fastener. Accurate stamping is essential, both to facilitate attachment and to provide a tight, springy folding action.

The most important innovation in the new system is the use of a dial feed in combination with two progressive dies on a 50-ton inclinable V & O press, *Fig.* 3. This piece of equipment makes the clamp halves, feeds the spring and eyelets, and automatically assembles and ejects the completed part. The only manual operation involved is that of placing the springs in the magazine at the spring insertion station on the dial feed.

The previous method of fabricating and assembling the clamp required 14 presses, each manned by an operator. Thirteen presses were used to make the clamps, while the remaining one made the spring. This press, which is used in the present production line, is now equipped with an eight-station progressive die.

Top output with this single-operation production method was 6,000 completed clamp assemblies per day, which required extensive overtime. Now, with only two pieces of equipment, 20,000 units

***Senior member ASTE Mid-Hudson chapter.**



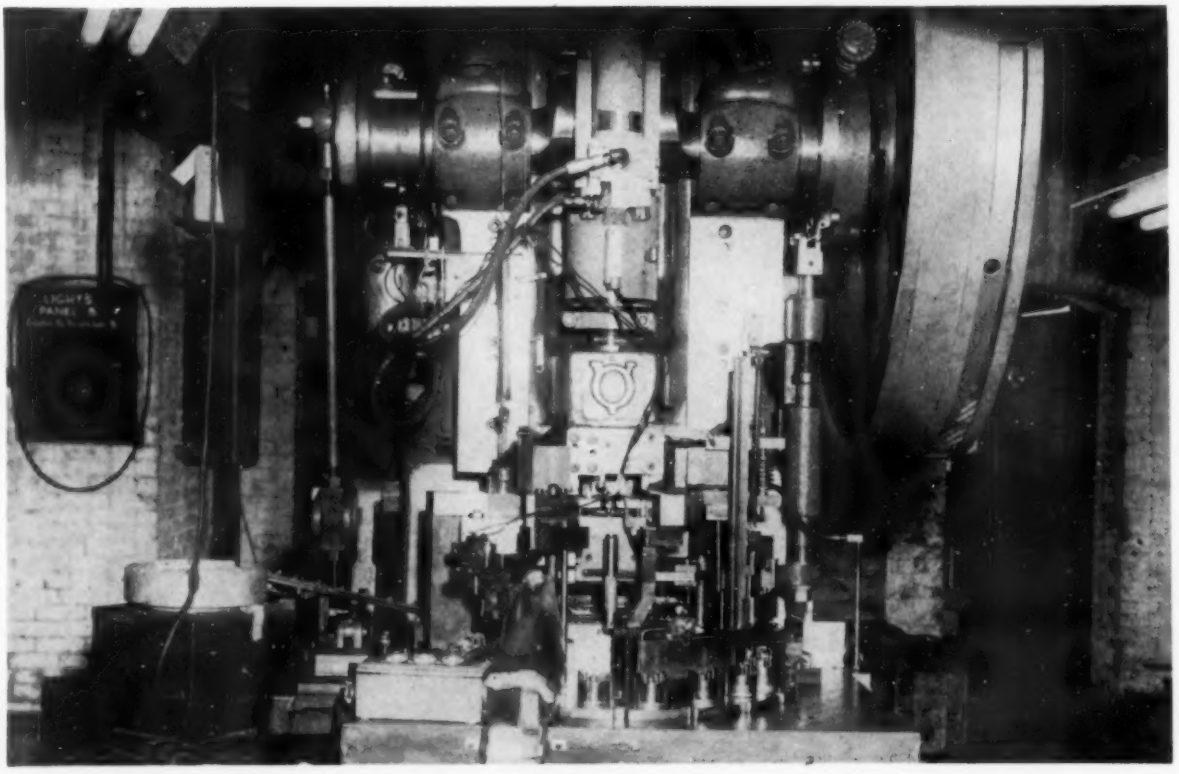
are produced in an average working day of seven and one-half hours.

Early in process planning, during consultations with press engineers, it was determined that it would be advisable to feed the stock through the back of the press and use two separate strips, feeding into separate progressive dies to form each clamp half. Rear feeding, *Fig.* 4, which was also used on the press making the springs, was advantageous in that it provided sufficient space up front for the dial feed and related mechanisms. Of course, it meant that the dies would have to be located well back of the centerline of the press stroke, but calculations indicated that press alignment would remain true.

Operating experience confirmed the line of reasoning followed in planning. When the dies were removed for sharpening after the first million pieces their condition was rated excellent. Now

Fig. 2. (left) Clamp halves for folding rules are produced in progressive dies and assembled in dial feed of the same press, *Fig.* 1, as follows: as the dial rotates, the spring is positioned, the male clamp half is formed and positioned, the female clamp half is formed and placed on top of the spring and male half. An eyelet is inserted and expanded and the finished clamp is delivered to a hopper.

Fig. 3. (below) Complete setup includes progressive dies in rear of press for forming parts and dial feed at front for mechanized assembly. Interconnected system of limit and precision switches stop the press if stock misfeeds or parts are out of register.



they are removed for sharpening after five million pieces.

An added advantage of rear feeding is that the dies are readily removed. In a matter of seconds, two nests on the dial are extracted and the empty space thus provided, when moved under the ram, gives adequate clearance for sliding the dies out on rails. Total time for removal is ten minutes.

The springs are made of 301 or 302 stainless steel 0.022-inch gage on a Number 0 V&O press. An eight-station progressive die is used. The strip feeding device has carbide pads at all points of contact with the strip. The operating sequence is as follows: the first station of the die pierces the center hole; two pilot stations follow; the next station deep scores; then an idle station provides die room; a forming station is succeeded by another idle station; the piece is then blanked and stacked onto pickup rods. Finished springs are strung on wire and aligned for loading into the magazine feed on the dial of the second press.

Springs are positioned in the nests of the dial by a cam-actuated slide. The slide picks up one spring from the bottom of the magazine and advances it over the nest. A plunger pushes the spring into position. The nest then moves underneath the blanking station of the die producing the male clamp half. As the clamp half is blanked, a pad inside the punch operated by differential pushrods pushes the clamp half through the die onto the nest over the spring.

The nest moves underneath the blanking station of the female clamp half and this part is also pushed through the die and placed on top of the male clamp half. Next the nest moves to receive the eyelet, which is fed from a vibration-type hopper. A pilot transfers each eyelet from the hopper track, inserting it into the hole in the center of the assembly, which advances to the staking station where the eyelet is expanded and the assembly completed. In this operation the pressure of the slide pushes the nest down, leaving the staking punch in a raised position.

As each assembly is finished, a spring-loaded jaw comes down over the clamp and picks it up. At the top of the press stroke, a solenoid energized by a limit switch sliding on the cam of the crankshaft kicks the clamp out into a chute.

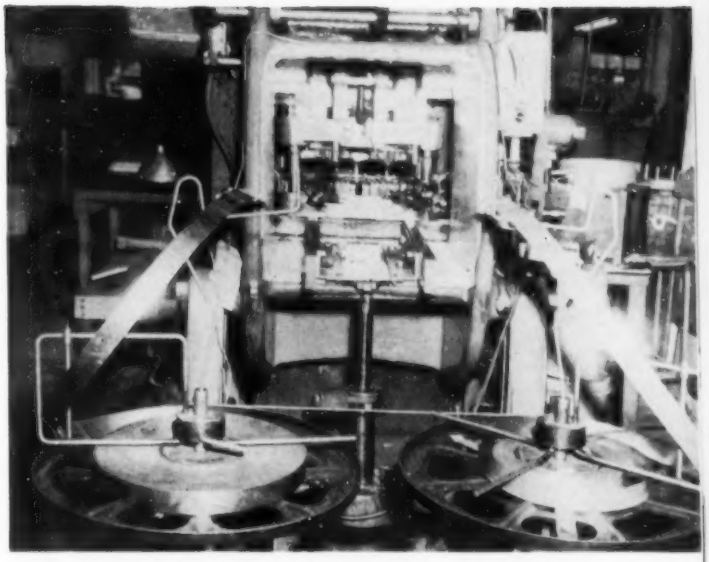


Fig. 4. Twin strips of brass feed through the back of press into the progressive dies which form male and female clamp halves.

Each of the progressive dies used to form the male and female clamp halves has thirteen stations. Both dies are equipped with spring-loaded pilots that will actuate limit switches if the stock misfeeds or is out of register to stop the press almost immediately. These switches are part of an interconnected system of limit switches which are located at critical operating points. Two switches are used with the magazine feed for the springs. Another switch is mounted on the hydraulic Pitman.

The gains achieved by combining operations have exceeded expectations. Boosting output upwards of 250 percent has resulted in substantially reduced unit cost. Any off-season surge in demand can be met readily. Finally, it has been found simple and economical to put the equipment onto a production operating basis for almost any size run.

Inter-Department Service in a Hurry

UTILIZATION of an airtube system to handle prints of engineering drawings for production work or for ordering parts has both speeded up and improved the work handling at Cleveland Trencher Co.

In the work setup the blueprint machine is located at the engineering files in the drafting room. This is approximately a 5-minute walk from the company's production areas. About 40 prints of engineering drawings are used daily, requiring considerable nonproductive time for pickup and delivery by messenger—and this costliness was doubled through wasted time in waiting. A third undesirable factor was the unnecessary traffic in the drafting room.

An airtube system, engineered by Lamson Corp., provides tubes that carry direct communications between the production control and material control departments and the blueprint machine. Carriers can be dispatched via the tubes in either direction and arrive at their destination in seconds.

find documents easily with Unit Term Indexing

By Robert A. Wason
Associate Editor

Since the value of organized technical information lies in the ability of a searcher to retrieve stored information, many systems fall into disuse because the one who searches may be using a different vocabulary than the one who filed. The system described here has proved successful for a huge mass of technical documents but can be applied to lesser quantities of information. The system was devised by Documentation, Inc., Washington, D. C., after long research into how best the Armed Services Technical Information Agency (ASTIA) could organize its many domestic and foreign documents so the information could be made quickly available to companies with prime military contracts.

MANY IDEAS AND CONCEPTS are expressed in language as combinations of words. The number of combinations for any body of information may be large, but the number of vocabulary terms is often surprisingly small. In the Uniterm System of Coordinate Indexing, information contained in a collection of documents is analyzed into simple word units of information—Uniterms.

For example, the word "machine" is associated with a number of different ideas in the phrases: "machine tools," pneumatic machines," "business machines," etc. There are two ideas, or terms, in the phrase "machine tools"—one the class of machine ideas and the other the class of tool ideas. When the two terms are used together, an operation called logical conjunction is performed. This simply means the combination of machine and tool. The order of terms is immaterial since the same information is represented by either arrangement, *Fig.* 1.

It is easy to see that a more specific area can be obtained by using a larger number of terms in conjunction, thus narrowing the field of search, *Fig.* 2. Since the same logical conjunction is obtained regardless of the order of terms, "machines," "tools" and "lubricating," when coordinated, are equivalent to the six possible ways by which this information can be represented in conventional indexing systems:

Machine tools, lubricating
Tools, machine, lubricating
Lubricating, machine tools
Lubricating, tools, machine
Machines, lubricating, tools
Tools, lubricating, machines

In the Uniterm system, each term is assigned a separate card, each document is assigned a number, serially in order of receipt, and the document number is posted on all cards headed by the Uniterms indicating the information contained in the document. Logical conjunction is achieved by searching for the document numbers that are common to two or more Uniterm cards. These documents then represent all the organized information in the area defined by the unit terms.

There is no reason to assume that "machine" is any more important than "tools" or "lubricating" and no term is made subordinate to any other as is done in conventional indexing. Making such assumptions at different times for different cases and by different people leads to elaborate cross referencing. Because of indifference to the order of words, the Uniterm System avoids cross references. The size of this system is a function of the vocabu-

lary terms rather than the number of ideas expressed by the combination of terms. For a collection the size of ASTIA's, reduction of index size is in the order of 90 percent.

After a body of information has been analyzed into Uniterms, the number of terms increases slowly as the catalogued information grows. As the system is introduced, the number of Uniterms usually exceeds the number of documents, an average of eight Uniterms is assigned to each document on a specific subject. A document is any single article, bulletin, research report, etc. With a total of 1000 to 3000 documents, the numbers of documents and terms are about equal. From that point on, the number of documents rapidly increases in relation to the addition of Uniterms.

Freed from the time-consuming necessity of making subjective decisions concerning word orders and cross references, the indexer is the first to benefit from the Uniterm System. Unit terms are assigned liberally and rapidly, and the foundation is made for a depth of analysis hitherto impractical. The poster simply transfers document numbers to the correct cards. Searchers can use the body of organized information with any point of view and as specific or general as they desire.

Uniterm systems can be organized for manual or machine manipulation. The manual method will be described since it will have wider application and because all basic ideas are identical. File cards can be of any convenient size and can be kept in trays, visible files or looseleaf volumes. Cards should have spaces at top and bottom for the Uniterm and are divided into ten columns numbered from zero to nine, *Fig.* 3. The columnar arrangement breaks up the mass of numbers and makes the search for common numbers simpler. Document numbers are posted on cards so they are in the column numbered to correspond to their last digit, in other words, all document numbers ending in "5" are listed in the column headed "5." No space need be left in any column since new numbers will always be higher than any posted. The first document is assigned the number "1."

To understand the simple search by logical conjunction of Uniterms, consider the cards in *Fig.* 3. Of the 882 (and perhaps more) documents contained in the indexed information, 29 pertain to machines, 24 to tools and 21 to lubricating. The essence of any successful search is to narrow the field of search. By looking for common document numbers, it is quickly seen that documents 230, 11, 882, 34, 785, 216 and 447 contain all the available information on machine tools. However, if the object of the search were "machine tool lubricating," it would be a waste of time to go through the seven documents that contain all the information on machine tools. By comparing this list of documents with those listed on the card for lubricating, it can be seen that documents 230, 882, 785 and 216 contain all the information pertaining to the search. In just two steps, the search has been reduced from 882 (plus) documents to four documents. These four would be easy to find since they would be filed in order by number.

There are 15 rules that apply to the setting up and maintenance of a Uniterm System of Coordinate Indexing. Some are concerned with indexing, most with posting and none with searching, although it is advisable that all who come in contact with the system be aware of all the rules.

Key Words: Determine key words that represent the subject content of the item being indexed. Key words are not limited to single common words, but can include phrases, Arabic numerals, alphabetical characters, model and project numbers, nouns, adjectives, gerunds, participles and proper names.

Record Key Words: Uniterms are recorded on cards so that every retrieval word is posted in the filing position. This is done by putting every word

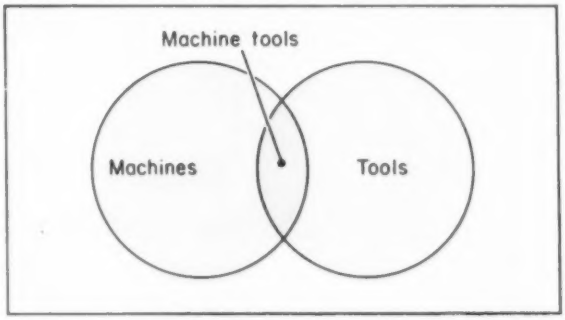


Fig. 1. All the filed information on machines and tools can be represented by overlapping circles. Some of the "machine" documents will concern machine tools and some of the "tools" documents will concern machine tools.

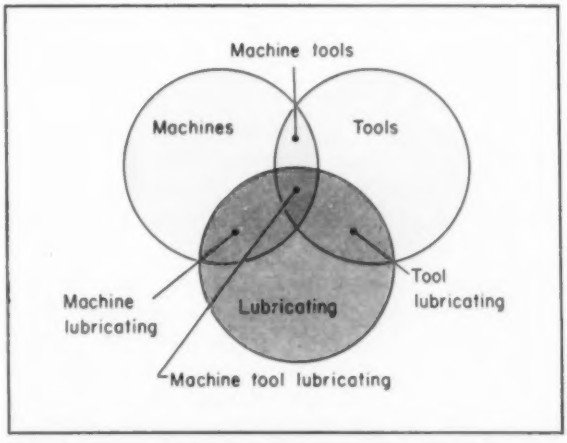


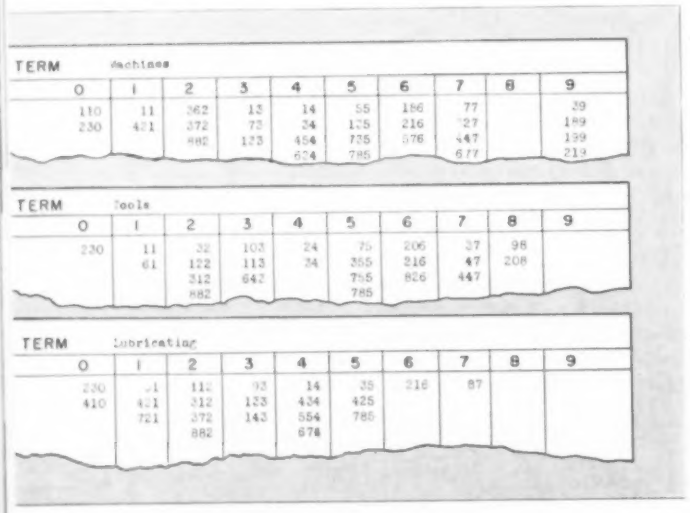
Fig. 2. By adding a third idea, the scope of a search is reduced. Few documents contain information on the lubricating of machine tools.

in a phrase in the filing position. If the phrase "gas turbines" is to be used, "turbines" must be recorded in the filing position as well as "gas." The poster must decide if the "turbines" and "gas" cards bear single words or phrases. A few words are not considered retrieval words, such as "effects" and "methods," and are not given separate cards.

Free Terms: If a word is used alone as an indexing term it is a "free" term and is entered as a single word on a file card. In the case of a document on "Helium in Air Turbines for Gasoline Pumps," "helium" is a free term. Being free once, it cannot later be bound with another term in a phrase.

Bound Terms: If a word in the filing position is used with only one other word in the vocabulary, it is a "bound" term. Each word of a two-word phrase is entered on a separate card on the filing position. The other word is added if the filing position word is a bound term. If the poster considers the phrase "air turbines" from the previous example, he will have only three Uniterms in the vocabulary:

Fig. 3. By comparing Uniterm cards to obtain common numbers of documents, the same type of overlap is achieved as that shown schematically in *Fig.* 2.



"helium," "air" and "turbines." Since both words of the phrase fit this rule, "air turbines" is typed on one card and "turbines, air" is typed on another.

Word Combinations: If a word occurs in the system in combination with two or more words, it is a free term. In the previous example, "centrifugal," "gasoline" and "pumps" are to be added to the vocabulary. "Pumps" is a free term because it is combined with "centrifugal" and "gasoline." Three new cards would be added: "Pumps," "centrifugal pumps" and "gasoline pumps." The word in the filing position is the one to consider whether bound or free. Free terms and bound terms can be added to bound terms, but no terms can be added to free terms.

As a system expands, the tendency is to free more and more bound terms. Freeing of a bound term is simple because it entails only the erasure of the binding terms from each of two cards. Document numbers are not disturbed.

Word Forms: Substantive forms are entered in the plural only, provided the singular can be inferred conveniently without broad change of meaning. Singular forms can be entered after plurals where the appearance of both terms would facilitate indexing and searching. Singular forms of foreign words are used with the plural form appearing after them. If the singular form of a word is broadly generic or defines a field and the plural is more substantive, the singular form is written in the filing position with the plural form added after it.

Attributive or adjectival forms should be added to the substantive words with which they stand in closest sense relationship, as in: "sun, solar," "hydrostats, hydrostatic" and "geophysics, geophysical." Gerundive forms are entered with the participles following, such as, "printing, printed." The forms of word endings do not affect filing order as in conventional systems because each word appears only once in the filing position.

Special Words: The first words of proper names and foreign phrases are considered bound terms and entered in the filing position with the complete phrases following them. Accepted chemical terms occurring as one word are used as Uniterms in the form in which they appear. Where true synonyms occur, enter the well-known form and make a "see" cross reference with the other form. Since the alternative forms are rarely consulted, they may be kept in a separate file. Homonyms are entered as a single Uniterm. Where meaning may prove to be unclear in coordination, meanings can be shown parenthetically on separate cards. The word "pitch," for example, might require four cards: pitch (substance), pitch (motion), pitch (acoustics) and pitch (angle).

Particular applications of the Uniterm System should be set up to meet the informational needs of the users. No special training is required to set up and maintain a simple system. The most important function within the system is the assignment of Uniterms to each document. Titles are good sources of basic words, but the value of the index will be greatly increased if the person who assigns the terms is familiar with the entire content of the document. If Uniterms are liberally assigned, each document will prove more useful.

method for determining correct amount of silver alloy brazing wire

FOR MAXIMUM JOINT STRENGTH and optimum use of materials when joining parts by brazing, proper amounts of brazing wire should be used. The engineering laboratory of Handy & Harman, New York, N.Y., has prepared the nomogram on the following page as a guide to the selection of correct alloy wire sizes for brazing tubular or linear joints with properties meeting specifications. The nomogram can be used where nominal tolerances are held on the machined parts to be brazed.

The nomogram can be used to indicate the wire diameter needed to silver braze a joint whose diameter, *Fig.* 1, or length, *Fig.* 2, shear depth or lap, and clearance are known. It can also be used to determine the length of wire needed to make a joint if a given wire size is already available. The chart is constructed to include allowances for normal machining tolerances and variations in worker's brazing techniques. An estimate of the amount of brazing alloy needed for a production run can be obtained by multiplying the amount of wire required for one joint by the number of identical joints to be produced.

With the joint type and dimensions known, the brazing wire diameter is found by entering the nomogram from the left-hand scale. From the correct joint length or diameter on this scale, a line is drawn through the correct point on the depth scale to the turning line. A line is drawn from this point through the clearance value (at brazing temperature) to the left-hand scale, which acts only as a turning line. From this point, a line is extended to the correct point on the wire length or ring diameter scale. This last line will cut the wire

Fig. 1. Dimensions for cylindrical joints.

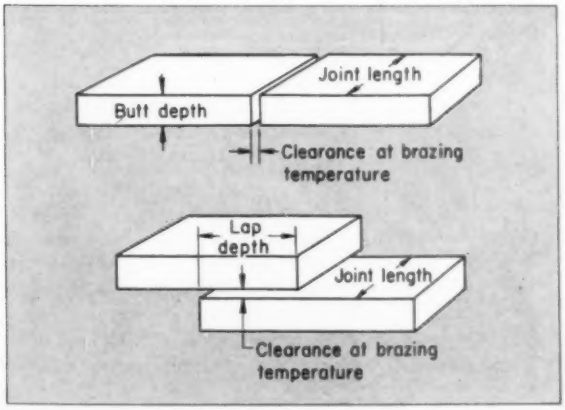
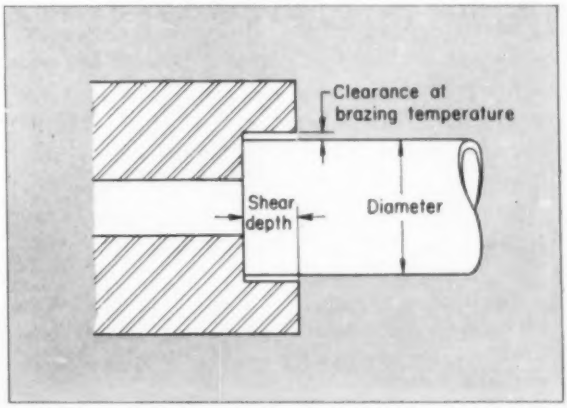
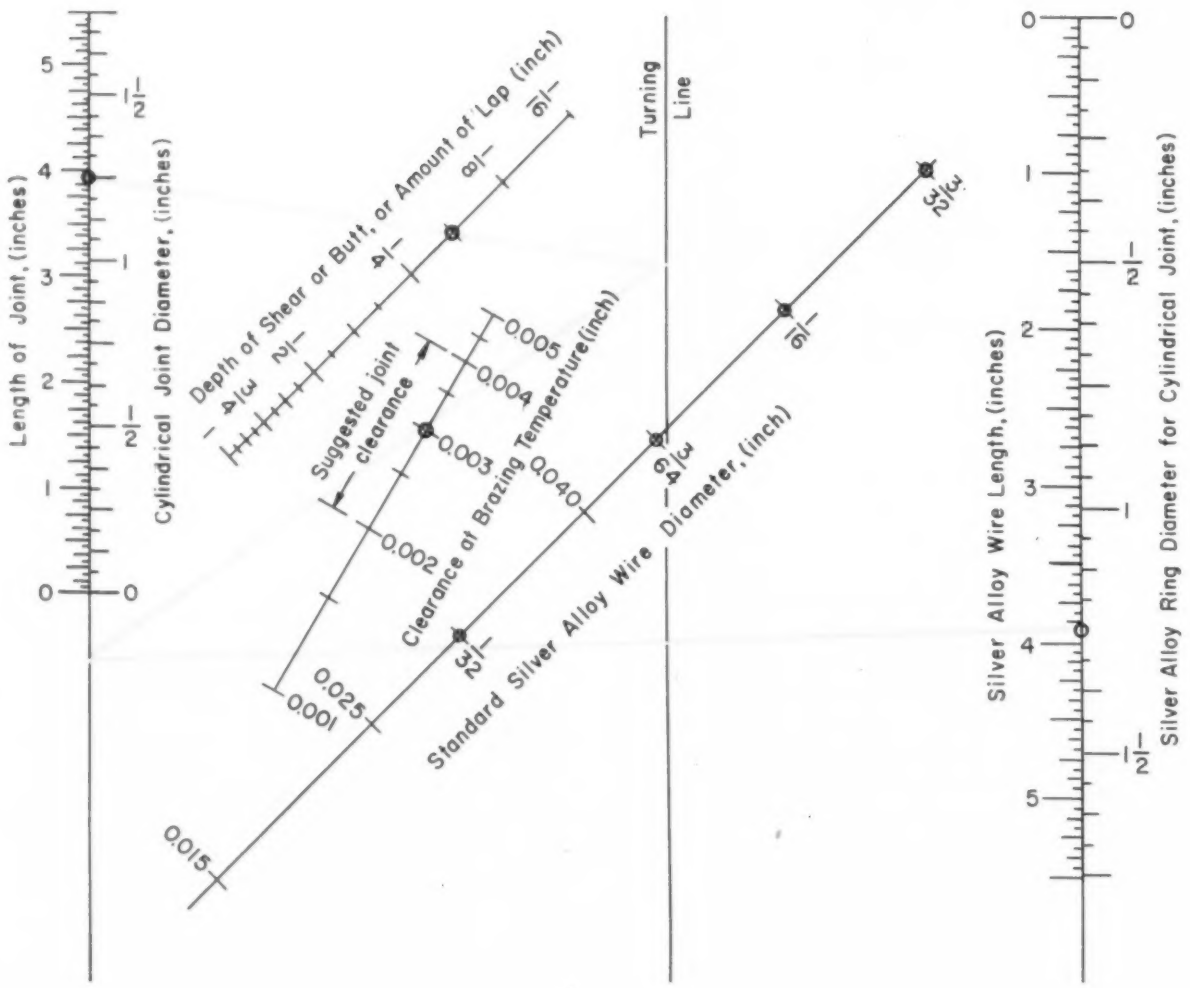


Fig. 2. Dimensions for linear joints.



Nomogram for Determining Silver Alloy Brazing Wire Dimensions


Length of Joint, (inches)
Cylindrical Joint Diameter, (inches)
Depth of Shear or Butt, or Amount of Lap (inch)
Suggested joint clearance
Clearance at Brazing Temperature (inch)
Turning Line
Standard Silver Alloy Wire Diameter, (inch)
Silver Alloy Wire Length, (inches)
Silver Alloy Ring Diameter for Cylindrical Joint, (inches)

diameter scale at a size that will make the required joint. When the line cuts this scale between wire diameter sizes, the larger size should ordinarily be used.

The nomogram is used similarly to find the wire length when the wire diameter is known. The only difference is that from the turning point on the left-hand scale, the last line is drawn through the wire diameter size to intersect the right-hand scale and indicate the length of wire that would have sufficient volume to fill the joint. In this instance, if a circular joint is involved, the right-hand scale should be read as wire length because the ring diameter will not usually fit the joint.

EXAMPLE: Given a cylindrical joint with a diameter of 1¼ inches, a shear depth of 3/16 inch and a clearance of 0.003 inch (at brazing temperature), determine the correct wire diameter.

SOLUTION (shown on nomogram): From 1¼ on the joint diameter scale at the left, extend a line through 3/16 on the depth scale to the turning line. From this point, draw a line through 0.003 on the clearance scale to the left-hand scale. From this point, draw a line to 1¼ on the right-hand scale. This last line cuts the wire diameter scale between 0.025 and 1/32. The correct wire diameter is 1/32 inch.

EXAMPLE: Given a 3-inch linear joint with a ½-inch lap and 0.001 inch clearance (at brazing temperature), determine the length of 3/64-inch diameter wire that should be used.

SOLUTION: From 3 on the joint length scale at the left, extend a line through ½ on the lap scale to the turning line. From this point, draw a line through 0.001 on the clearance scale to the left-hand scale. From this point, draw a line through 3/64 on the wire diameter scale to the right-hand scale. This last line intersects the wire length scale at 1⅛, which is the required length in inches of the available wire.

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Prof. Nathan H. Cook

Prof. Milton C. Shaw

Prof. Prescott A. Smit

MIT Conference

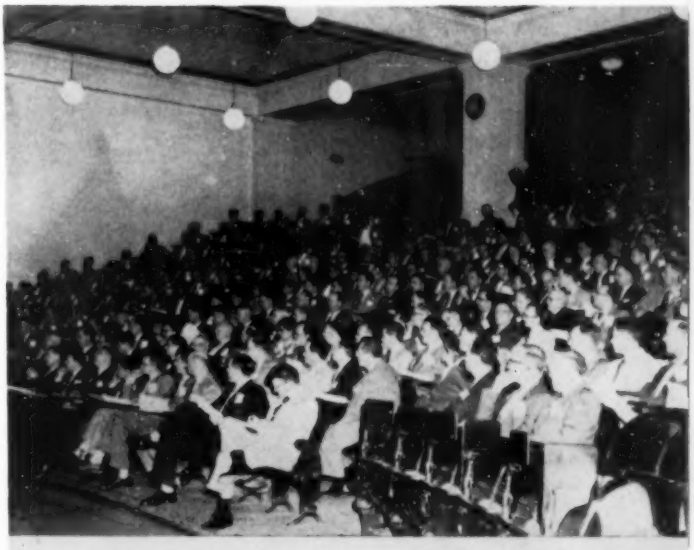
Saturday, May 7, was a red-letter day for the six ASTE chapters in Massachusetts. Culminating many months of preparation, the date marked the first on-campus conference held at the Massachusetts Institute of Technology.

A total registration of 425 was recorded, with tool engineers coming in from all over New England and as far away as Poughkeepsie, N. Y., and Baltimore, Md. They were welcomed to MIT by Vice Admiral E. L. Cochrane, vice president of the school.

Participants in the all-day program, in addition to those pictured, included: Robert L. Douglas, ASTE past president and head of the Society's Research Fund Committee; Joseph P. Crosby, immediate past president of the Society; Charles F. Clark, assistant sales manager of Cincinnati Milling Machine Co.; and L. D. Miles, manager of the Materials Services Div., General Electric Co.

Special guests at the conference were: Ray Morris and Roger Waindle, past presidents; Richard Smith, a national director; and Joseph Petz, W. B. Wells, and Philip Marsilius, national committee chairmen.

Chairman of the conference committee was Karl G. Nowak, national delegate from Boston chapter.



Luncheon guests included these officers of sponsoring chapters: (from left) R. E. Holbrook, Southeastern Massachusetts chairman; R. W. Huxtable, Northern Massachusetts chairman; Dr. Leo Tarasov, Worcester vice chairman; H. B. Moore, Springfield, Mass., chairman; and Charles Sadon, Boston chairman. Merrimack Valley chapter was also a sponsor.

ASTE Conferences

university of houston

Some practical ways to increase profit were outlined at an evening session by H. Dale Long, national ASTE treasurer and president of Scully-Jones & Co. At the table is Carl Houston, assistant dean, College of Engineering at the University of Houston.

"Increased Profit Through Increased Production" was the theme of the first ASTE on-campus conference held at the University of Houston. The two-day meeting, held April 22-23, was under the joint sponsorship of the university's College of Engineering and the Houston chapter of ASTE.

Participants, in addition to those pictured, included: Dr. J. T. Elrod, director of the industrial engineering department; L. J. Castellanos, chairman of machine design; S. A. Brandenburg, vice president of Monarch Machine Tool Co.; and Otis Traughber of the National Membership Committee.

The evening banquet was held in Oberholtzer Hall.

Below are some of the principals who appeared on the Houston program. From left are: W. F. Strong of General Electric Co.; D. H. Apgar of International Business Machines, Inc.; M. L. Begeman, chairman of the Houston's mechanical engineering department; and M. F. Judkins of Firth Sterling, Inc.

Tennessee's first ASTE conference, devoted to metal processing, was held on May 6-7. Hartley W. Barclay, second from left, industrial advertising manager of the *New York Times*, was keynote speaker at the evening banquet. Greeting him are members of the program committee: from left, I. O. Johnson; Prof. C. C. Lasater, chairman; and G. W. Richardson.

Participating in an afternoon technical session were, from left: George L. Morin of Jones and Lamson Machine Co.; E. W. Pughe of Wheland Co., chairman of the session; and Dr. M. Eugene Merchant of Cincinnati Milling Machine Co.

university of tennessee

Those who attended the Metal Processing Conference had this group portrait taken.

H. Dale Long Guest at Fond du Lac Meeting

H. Dale Long was a special guest at the May 13 meeting of the Fond du Lac chapter held at Art's 151 Club. H. Dale Long, national ASTE treasurer and president of Scully Jones & Co., appeared in the dual role of national officer and technical speaker.

After a brief discussion of services which the Society performs for its members and member chapters, Mr. Long presented an illustrated talk on "Practical Ideas for Reducing Manufacturing Costs." Approximately 90 members and guests attended this meeting.

—Walter M. Gradolf

Forms New Company

Paul Erik Dillberg, secretary of the Hartford ASTE chapter, has formed a new company under the name of Machine Tool Sales. Located in West Hartford, Conn., the company will serve the New England area in designing, servicing and selling of complete chucking and workholding equipment for industrial use.

SALT LAKE CITY — This officer group includes William J. Bullough, chairman; Wes Lane, first vice chairman; Joe Oviatt, second vice chairman; and Wendell P. Paxton, treasurer.

Chief Service Engineer Speaks at Cincinnati

Kenneth N. Macomber, chief service engineer for the Lapointe Machine Tool Co., spoke on "Electromechanical Broaching" for members of the Cincinnati chapter on April 12. He used two films to show the many features of the Lapointe broaches. The meeting was held at the Engineering Society headquarters and approximately 45 attended.

—Barton Jones

Studying Standards for Diamond Tools

Standard styles and dimensions of single point diamond dressing tools are the objectives of this subcommittee of the American Standards Association Sectional Committee on Industrial Diamonds and Accessories for Their Use. Known as B67, the committee is sponsored by ASTE and the Industrial Diamond Association.

Pictured here, from left, are: G. H. Harnden; Gilbert Stewart; Clyde Fanning, chairman of B67 and a member of the ASTE National Standards Committee; George Hargreaves, staff administrator for ASTE; Jerry Krandall, vice chairman of B67 and a representative of the Industrial Diamond Association; C. A. Brown; D. E. Stone; D. J. Wallace; and L. K. Pruett.

These members, headed by Mr. Krandall, are studying the 250 styles and sizes of diamond tools now being used with an eye to reducing the number to what is actually needed to meet industry needs. The number may eventually be less than a dozen. Although there will always be needs for special sizes and shapes, it is estimated that at least 90 percent of all dressing tools could be standardized.

Another B67 subcommittee, with Mr. Stewart of the National Machine Tool Builders Association as chairman, has proposed nomenclature for diamond tools which is ready for review by all interested parties.

Tool Engineers' Day Observed in New York

The third annual Tool Engineers' Day in New York was sponsored this year by the Greater New York chapter. Held on May 2 at Hotel New Yorker, the event was attended by approximately 325.

The day's program began with plant visits which included the New York Naval Shipyard in Brooklyn; Merrill & Sons Forging Shop in Maspeth; and the Ford Motor Co. assembly plant in Edgewater, N. J.

A technical session in the late afternoon featured "Production Tooling for Induction Heating Equipment" by Herbert U. Erston, chief mechanical engineer for Induction Heating Corp. in Brooklyn.

The banquet in the evening was highlighted by the presentation of the 1955 Award Citation for distinguished public service to John M. Olin, chairman of the board of Olin-Mathieson Chemical Corp. A sterling plate, suitably engraved, was presented to Mr. Olin by William F. Reber, chairman of the Greater New York chapter.

Col. Willard F. Rockwell, chairman of the board of Rockwell Mfg. Co., was the keynote speaker and Burnham Finney, editor of the *American Machinist* was toastmaster for the evening.

—Jean Nazeley

Lima Members Tour Oil Seal Plant

A plant which produces 2 million oil seals each month, was object of a tour by members of the Lima chapter recently. The National Seal Co. in Van Wert, Ohio, was host to 31 members. The group viewed facilities where 3000 different designs of oil seals, used extensively in the automotive and machinery parts industry for retaining lubricants and as a protective measure for bearings and moving parts, are made.

—G. D. Stemen and J. R. Harman

Dallas Company Visited by North Texas Members

A plant tour of the Folsom Co. in Dallas was made May 13 by the North Texas chapter. Part of the program consisted of a sound and color film shown by the Elox Corp. of Michigan.

In April chapter members heard a lecture on "Science of Precision Measurements" by a representative of DoAll Corp. This session was held at Fort Worth International Airport.

—Joe E. McClendon

Ashtabula County Chapter receives ASTE charter

Serving tool engineers in Ashtabula County, Ohio, the Society's 127th chapter was chartered in April by ASTE President Harry B. Osborn, Jr. Ceremonies took place at a charter night dinner held at the Swallows Restaurant.

Installed as officers of the group were: Carl Zehr, chairman; John S. Erickson, first vice chairman; James S. Roberts, second vice chairman; Edward J. Sharkey, secretary; and Warren Moran, treasurer. They were sworn into office by Dr. Osborn.

The chairman's pin was presented by Andy Clark, member of the Society board of directors. Frank A. Flannery of the National Membership Committee presented the ASTE baby bottle symbolizing the newest addition to the ASTE family. The membership kit was presented by Marvin J. Bunting, staff administrator at national headquarters.

Special guests at the event included: Ned Collander, Ashtabula city manager; Ralph Wright, mayor of Conneaut; and Joseph Malone, mayor of Geneva. Cleveland ASTE chapter was represented by Mr. Berg and Western Reserve chapter was represented by Chairman Ray Beatty.

Officers of the Ashtabula County chapter were sworn in by President Osborn. They are from left: Warren Moran, treasurer; Edward Sharkey, secretary; James Roberts, second vice chairman; John Erickson, first vice chairman; and Carl Zehr, chairman.

These smiling faces include those of Dr. Osborn, Frank A. Flannery, Carl Zehr, A. B. Clark, and Marvin J. Bunting.

Pictured at the Santa Ana Valley meeting are: Harlan Messner; Harry Earle, chairman of the industrial relations committee; Dr. Osborn; Paul Jones, Jr., chapter chairman; and Pat Curley, program chairman.—*Len Krow*

Speaking Tour Takes ASTE President Osborn to Meetings of Ten Western Chapters

Technical sessions and executive meetings held almost daily from May 2 through May 18 were on the docket for Harry B. Osborn, Jr., president of the Society, as he made his recent tour of western chapters. Arranged by James Matthew of the National Program Committee, the special tour included visits to Phoenix, Tucson, San Fernando Valley, San Gabriel Valley, Santa Ana Valley, San Diego, Long Beach, Los Angeles, Santa Clara Valley and Golden Gate chapters.

Topics under discussion covered matters on chapter operations, such as membership, finance and laison with national headquarters, as well as policies, programs and activities of national scope, including the ASTE industrial expositions and THE TOOL ENGINEER magazine. Attention was also given to modern trends in engineering education, the status of the tool engineering profession, qualifications for belonging to ASTE, and the proposal for changing membership classifications.

This threesome of Tucson's May meeting included Jim Matthew; Dr. Osborn; and Harry McClain, chairman.

—*Joseph Vincent*

In addition to his role as president of the 31,000-member Society, Dr. Osborn also acted as technical speaker at many of the meetings. In his capacity as technical director of the Tocco Division of Ohio Crankshaft Co., Cleveland, Ohio, he addressed members on the subject "Tooling for Induction Heating."

This group at the Los Angeles meeting includes: Ralph Chrissie; Wayne Ewing, national fourth vice president; Dr. Osborn; Ben Hazewinkel, national director; and Al Beaumont, member of the National Membership Committee.

—*Roland Hamel and Gene Grahn*

St. Louis Honors Demuth, Doogan and Nieman

In appreciation of their past service to the chapter, special wards were presented to three St. Louis ASTE members at the May 5 meeting. Honored were J. J. Demuth, E. A. Doogan and E. H. Nieman.

The technical program was offered by Frank Zagar, president of Zagar Tool, Inc. He discussed drilling, reaming and tapping operations in a talk entitled "Jig Design and Operational Technique." Some 85 members and guests attended the session held at the DeSoto Hotel.

—*Wilfred C. Graeler*

Physical Metallurgy Los Alamos Topic

Members of the Los Alamos chapter heard Jordon Hoffman speak on "Physical Metallurgy" at a May 11 meeting in the Little Theatre. Mr. Hoffman, section leader at the University of California in Los Alamos, showed slides and discussed addition of various elements—such as carbon to steel, and the resulting hardness, wearing qualities. Correct methods of heat treating and proper steels for good die design and tool fabrication were also discussed by Mr. Hoffman.

—*Lewis C. Osborn*

Automatic Tooling Topic at Granite State

"Automatic Tooling" was the subject of a technical talk delivered at the May 17 meeting of the Granite State chapter. E. H. Flook, manager of the Richmond territory for National Automatic Tool Co., illustrated his presentation with slides. Forty-eight attended the meeting.

Darrell Mitchell, second vice chairman of the chapter, has a new position as design engineer in Springfield, Vt., and will be leaving the chapter. Taking over his duties will be Robert Lamson.

—*Kenneth R. Stowe*

SANTA CLARA VALLEY AND GOLDEN GATE—Chapter officers who met with Harry B. Osborn, Jr., center, ASTE president, on his recent western tour included: (from left) Alan G. Dimond. John Groves, Carl F. Kaiser and Frank Menard of Santa Clara Valley; Dr. Osborn; and Ted Lindquist, Jack Giezendanner, W. G. Burge, and Philip R. Freeman of Golden Gate.—*W. H. Forbes and J. E. Wilson*

Prof. McKee Addresses Engineers' Day Audience

Robert E. McKee, chairman of the ASTE National Education Committee, was one of the principal speakers on the April 16 Engineers' Day program held at the University of Mississippi. Prof. McKee of the production engineering department, University of Michigan, outlined the educational goals of the Society and how industry may benefit from them.

McKee

Crane

E. V. Crane of the E. W. Bliss Co. presented a technical session on the program also. Mr. Crane's talk, dealing with "The Plastic Flow of Metals in Mass Production Stamping Operations," was illustrated by color slides and two films on the new strip feed press and 1000th transfer feed press.

The day's activities also included laboratory demonstrations and visits to displays. A banquet and dance wound up the day's events. Memphis chapter was a co-sponsor. —*Ralph Schuring.*

SAN FERNANDO—Awards for getting new members were made recently to John Snook and Ralph Sauter. Shown with them at the right is Ralph Dorn.

Metalworking with Wax Topic at Baltimore

Describing the practical use of wax in machining of metals, J. P. Guyer, Jr., regional supervisor of Industrial Products Division of S. C. Johnson & Son, Inc., spoke before 90 members of the Baltimore chapter on April 6. Preceding the technical session a film was shown on "The Mexican Road Race," courtesy of Socony Vacuum Oil Co.

—*Raymond T. Crew*

Appointment Announced

R. E. Zahn has been appointed manager of tool steel sales for the Dayton district of Allegheny Ludlum Steel Corp., according to an announcement by Russell M. Allen, vice president in charge of sales.

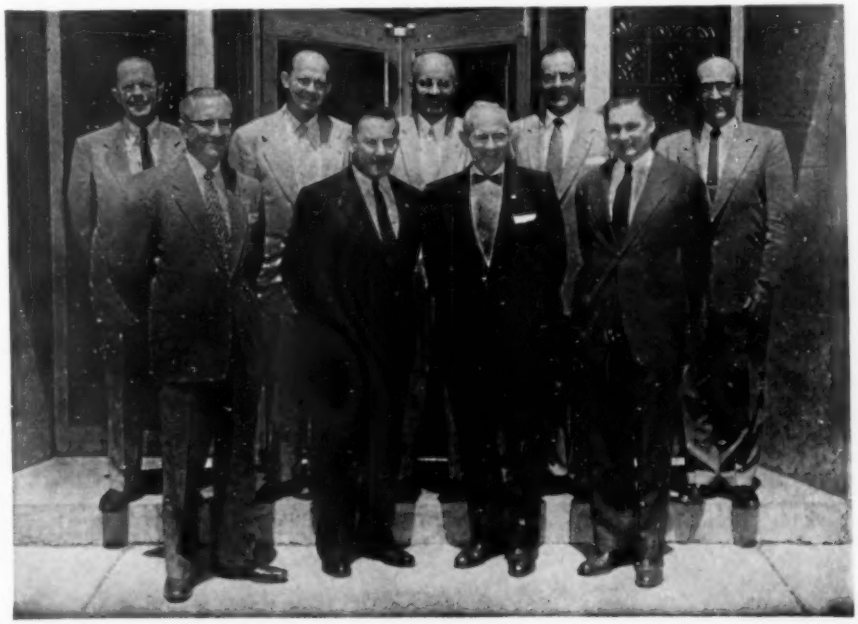
Positions Available

SALES REPRESENTATIVES OR DISTRIBUTORS—wanted to handle new line of instrument tool components of over 300 sizes made principally of stainless steel. Territories throughout country open. Send complete resume and items now handled, including references to Box 046, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

CARBIDE TOOL SERVICE ENGINEER—Challenging lifetime opportunity for experienced man to work with representatives of progressive carbide manufacturer. Must be free to travel. Send full resume to Box 047, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

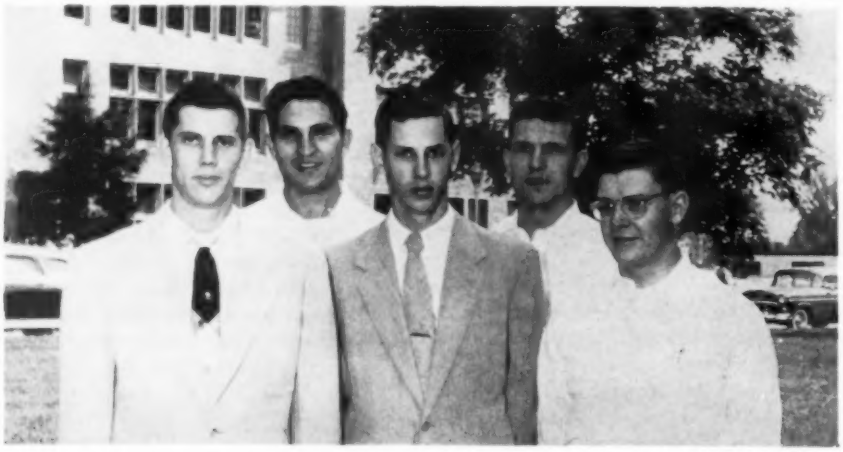
Position Wanted

SALES ENGINEER or MANUFACTURERS' AGENT—looking for connection as direct company representative. Will also consider starting mfr.'s agency. Many years' experience selling tools and carbides to both users and jobbers in East Pennsylvania, New Jersey, Delaware, and Maryland. For details write to Box 045, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.



First meeting of the 1955-56 National Editorial Committee was held in May at national headquarters in Detroit. Participating were: (front row) Howard C. McMillen, national second vice president; Joseph L. Petz, committee chairman; Ben Berlien, vice chairman; and Allan Ray Putnam, assistant executive secretary and publishing manager. Back row: Lee M. Davis, Donald E. Wernz, Donald E. Zierk and Ralph F. Mueller, committee members; and John W. Greve, editor of *The Tool Engineer*. Harold Hagle is also serving on the committee.

PATERSON—Pictured at their installation night are these chapter officers: (front row) Conrad Corsini, national delegate; George Fleming, first vice chairman; Park Groff, Jr., chairman; Richard A. Smith, national director of ASTE who conducted the installation; and George D'Angelo, secretary. Back row: Charles Bazaz, alternate delegate; Robert Neeb, second vice chairman; and William Aucamp, treasurer. The most valuable member award went to James McCann.—*B. N. Kluger*



EVANSVILLE—Five students of Evansville College were given honorary memberships in the Evansville ASTE chapter at the school's College Day on May 4. Memberships went to, from left: Robert Wallenmeyer, William Northern, Howard Happe, William Agnew and George Reemford. Five students at Lain Drafting College received memberships the previous month at a banquet. They are: James C. Mayo, William A. Richardson, Raleigh M. Snodgrass, Leroy B. Martin, and Albert W. Cox.
—*A. C. Rosencranz*

ROCKFORD—Awards for proficiency in drawing were presented to high school students at the May 12 meeting. Three winners are pictured here with John Bartz, center, superintendent of industrial education for the state of Illinois; and Ed Schenk, left, chairman of Rockford chapter's education committee. Robert Niedigh, second from left, won a $25 award; John Pruner, second from right, received the grand prize award of $40; and Gilbert Ahmer, far right, received a $25 award.

Portland, Me., Chapter Visits Keyes Fibre Co.

Various processes used in turning out molded pulp and fiber products were studied by Portland, Me., members at a plant tour made May 13 at Keyes Fibre Co., Waterville, Me. A brief history of the firm was given by Robert O. Brown, personnel director, who also discussed production techniques employed by the company. The program was followed by dinner at the Jefferson Hotel.

—*Robert P. Chaplin*

E. D. Frank Dies

E. D. Frank, 69, director and vice president of sales for the National Automatic Tool Co., died suddenly at a machine tool builders' meeting in Chicago on May 5. Natco's oldest employee in point of service. Mr. Frank had been with the company 44 years, first in the engineering department, then as superintendent of engineering and finally director and vice president in charge of sales. A native of Vienna, Austria, Mr. Frank settled in Cincinnati and was brought to Natco by its founder, W. F. Bockhoff. He was made vice president in 1931 and a director in 1948. He was a member of Richmond ASTE chapter.

Mathematical Tricks Revealed at Evansville

With chalk in hand, Ed Meredith, supervisor of methods and standards at the Hoosier Cardinal Corp., demonstrated various methods of obtaining a quick check of accuracy on mathematical problems at Evansville's May 9 meeting. Mr. Meredith also revealed many tricks and short cuts in solving multiplication problems.

Also on the program was Joseph Halbig, evening's program chairman, who showed a film on drop forging. Approximately 65 attended this meeting at Ruthenburg Field.

—*William H. Brooks*

Rockford Honors Dickett, Johnson and Lund

Awards for service as chapter chairmen and national directors were given May 12 to Ed Dickett, George Johnson and Ken Lund. The presentation took place at a meeting held at the Lafayette Hotel. The technical program covered the topic "Machining Modern Metals." Speaker was Malcolm Judkins, manager of the Special Products Div., Firth-Sterling Corp. —*Les Teachout*

Position Available

CHALLENGING OPPORTUNITY—for electronic instrumentation engineer with leader in gaging field. Position is waiting for a man of ability and initiative to set up and head up an electronics department in a company well known in the mechanical field. This department would be responsible for development of electric and electronic gaging equipment, as well as applications of automatic gaging to sorting and machine control. Opportunity is as extensive as the ability of the man selected for the job. Required for a position of this responsibility is a considerable amount of instrumentation experience, background and/or absorbing interest in dimensional control and ability to head a department. Salary to be commensurate with experience. Location, eastern part of the country. Include photograph and write to Box 044, News Department, The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

FORT WAYNE—"Operation Pushbutton" was presented by Ed Bohse, right, field engineer for Bellows Co. at Fort Wayne's April meeting. At left is Richard W. Good, first vice chairman.

—R. H. Bienz

PONTIAC — C. F. Staples, left, receives his recognition award for past service as a national director of ASTE, from Charles King, chairman of the Pontiac chapter. The presentation was made at the April technical meeting.

HARTFORD—New officers of the Hartford chapter are Paul Dillberg, secretary; Joseph Balciunas, chairman; Henry Gotta, first vice chairman; Harry Anderson, second vice chairman; and Howard Wheeler, treasurer.

Niagara Speaker Reviews Forging Techniques

Niagara District chapter offered a technical program on recent developments in forging techniques at the May 5 meeting. Speaking to an audience of 120 members and guests was Eugene C. Clark, Jr., vice president and general manager of Chambersburg Engineering Corp. His presentation included two sound films on forging.

In addition to the technical session, George Bevis gave a coffee talk on the importance of tool engineers in maintaining the present economy. Mr. Bevis is associated with Reliance Electric Co. in Welland.

—William A. Yaeger

Developments in Turning Discussed by Brandenburg

About 100 Racine members were on hand for the May program presented by S. A. Brandenburg, vice president of Monarch Machine Tool Co. "Latest Developments in the Turning Field" was his topic.

A film showed various high production turning problems, machine time, feeds and speeds. A brief talk covered the future of the modern engine lathe and problems that have arisen as experiments are carried out. Individual production problems of the members present were discussed following the presentation. *—Alvin J. Michna*

Elected Vice President

G. T. Flammia had been elected vice president and general manager of the Sossner Tap & Tool Corp. of Lynbrook, N. Y., according to an announcement by T. T. Sossner, executive vice president of the firm. Before joining the firm, Mr. Flammia, a member of the Long Island chapter of ASTE, was associated with Bay State Tap & Die Co.

Smith d'Arcambal

A. H. d'Arcambal Installs New Hartford Officers

A. H. d'Arcambal, special guest at Hartford's annual ladies' night, installed officers of the chapter. Mr. d'Arcambal, national ASTE president for 1940-41, is vice president of Niles-Bement-Pond.

Some 230 attended the event at Indian Hills Country Club on March 7. Retiring Chairman Robert Gay turned the meeting over to New Chairman Joseph Balciunas who cut the meeting short in order to permit entertainment and dancing to start. A highlight was the presentation of an ASTE tie clasp to Mr. d'Arcambal by Richard A. Smith, a national director of ASTE.

—Merle S. Fogg, Jr.

Award Presented to William A. Thomas

Highlighting the May 9 meeting of Windsor chapter was the presentation of the past director's pin to William A. Thomas, who has also served as national assistant secretary-treasurer and secretary. Mr. Thomas was elected at the March session of the House of Delegates to serve on the 1955-56 board of directors.

Technical speaker on the program was Arthur Riddiford, Jr. of the John S. Barnes Corp. He spoke on hydraulic applications to machine tools.

—F. D. Rail

Hendrick Hudson Makes First Education Award

Hendrick Hudson, as a recently organized chapter, made its first award on May 24. The chapter presented a *Tool Engineers Handbook* to William Tulley, a student at Hudson Valley Technical Institute in Troy, N. Y. Selected as the most proficient and competent in his class in the field of tool design, Mr. Tulley received the award from William Edmiston, chairman of the education committee, at his school's commencement exercises.

The May 19 meeting of the chapter featured a talk by Harold P. Granger, eastern regional manager for The Bellows Co. The subject of his presentation was "Controlled Air Power Devices Are Used for Faster, Safer, Better Production." Sixty-eight attended the meeting. *—Benet Ripin*

Massachusetts Chapter Hears O. A. Nierendorf

"Reducing Grinding Cost" was the technical topic at the May meeting of the Southeastern Massachusetts chapter. Speaking to the audience of 82 members and guests was Oscar A. Nierendorf, head of the precision section of the sales engineering department of the Norton Co. Mr. Nierendorf also showed a film on the making of abrasive tools. The program was held at Taunton, Mass.

In April the chapter heard a talk on modern quality control given by Warren R. Purcell, industrial consultant at Rath & Strong, Inc. Announcement was made at this meeting that total membership in the Southeastern Massachusetts chapter had reached 173. *—Karl W. Nittel*

Wilson Ryno, left, national delegate for Northern New Jersey chapter, and H. E. Dietrich, right, vice chairman, are welcomed by A. Lundius, plant manager at Hyatt Bearing Div.

Northern New Jersey Visits GM Plant

A plant tour at Hyatt Bearing Div., General Motors Corp., was on the agenda for Northern New Jersey chapter's April meeting. About 80 members took part.

They were greeted by A. Lundius, plant manager, and several other officials, who acted as guides, explaining the tooling problems of roller bearing manufacture. After the tour Mr. Lundius conducted a question and answer period. *—S. W. Haas, Jr.*

ASTE Industrial Exposition and 24th Annual Meeting will be held March 19 through 23, 1956 at Chicago, Ill. The Exposition will be held at the International Amphitheatre.

Twin Cities Members Present Informal Program

A diversified program greeted the 106 Twin Cities members who attended the chapter May 4 meeting. On the agenda were Scott-Atwater Company's film, 'Portage to Alaska"; Seager Refrigerator Company's 'Lake Airs Quartet'; and colored movies and slides of the chapter's plant tour of Tubular Micrometer Co. Refreshments and a dutch lunch were also included. *—R. Roy Wressell*

Australia-Bound

Paul Travers, second vice chairman of the Louis Joliet chapter and machine shop and welding superintendent at Caterpillar Tractor Co., has been promoted to manager of manufacturing of Caterpillar's new plant in Melbourne, Australia. Taking his place as second vice chairman in the chapter will be Donald Briggs of Ford Aircraft Co.

Hobby Night Held by Mid-Hudson Chapter

Various demonstrations of products and equipment for 'do-it-yourself' home activity highlighted Mid-Hudson chapter's hobby night held in May. More than 100 members and guests attended the dinner session held at the Polish American Club.

The program was presented by: Roy Keith of Montgomery Ward, William Lampert of Van Benschoten Hardware Co., and Anthony Egle and Harry Goldstein of E. V. Grant Co. They gave demonstrations of the DeWalt Home Shop, the Shopsmith, Pittsburgh interlocking wall tile, and paint rollers. *—Davis Gale*

MID-HUDSON—A plant tour, dinner and technical program at International Business Machines Corp. were the drawing cards for these 250 ASTE members and guests who attended the chapter's April meeting in Poughkeepsie.

KALAMAZOO—C. A. Elzinga, past chairman, reads the charge to new officers of the Kalamazoo chapter at the April 26 meeting. From left they are: D. W. Nantz, secretary; R. E. Siegel, first vice chairman; Glen Rue, chairman; Cloyce Hanshire, treasurer; Roy Hedberg, second vice chairman; and William Kemp, alternate delegate. Guest speaker was Edward J. Jettery, sales engineer for Elox Corp., who discussed electrical discharge machining. Eighty-nine attended.—*T. J. Cook*

Brewing Process Viewed by Kansas City Chapter

The May 4 meeting of the Kansas City chapter was held in the Cypress Room of the Geo. Muehlebach Brewing Co., where George Willis, chief engineer for the company, reviewed the brewing process from beginning to bottling.

An election was held to fill the vacancy in the office of second vice chairman. Ralph Adkins was elected to fill the position. —*Gene E. Brunson*

Tri-Cities Chapter Hears Waldo Russell

A talk on "The Art of Reaming" was presented in May at a meeting of 101 members and guests of Tri-Cities chapter. Speaking to the group was Waldo Russell of the production design and application department of Cleveland Twist Drill Co. He was accompanied by A. P. Stohl. The program included a 30-minute sound film and a discussion period. —*Don Shewry*

Long Beach Takes Part in Local Award Program

Kenneth Nelson, past chairman of the Long Beach chapter's education committee, was asked to serve as a judge in the Long Beach City College's Industrial Arts and Vocational Arts Awards competition.

Among winners in the division of tool design and development were John Black, Norma Collins, Glenn Smith and William Talbot. These talented individuals were introduced at the May 11 meeting of the Long Beach chapter and will get *Tool Engineers Handbooks* on behalf of the chapter. —*Jack B. Irby*

Friends of Past President Albert M. Sargent were saddened to learn of the passing of his mother, Alice A. Sargent, on May 7 in Concord, N. H. She died at the age of 88 at the home of a daughter.

Mrs. Sargent attended several ASTE conventions during the 1940's, and her presence at these events was always recognized with warm introductions made at the annual banquets.

The sympathy of ASTE members and the headquarters staff is extended to Mr. Sargent and his family.

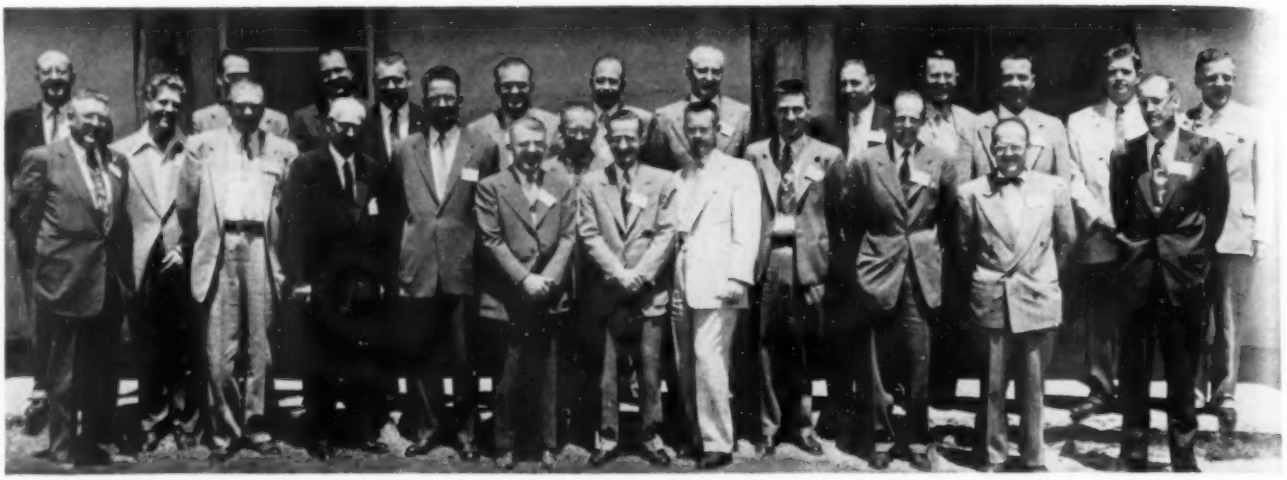
Warren Turner Addresses Muskegon ASTE Members

A talk on modern machine practices and a special film on atomic power were on the May program for the Muskegon chapter. The lecture was given by Warren L. Turner, supervisor of engineering Service Dept., Cincinnati Milling and Grinding Machine Co., Inc. He discussed milling and broaching operations and replacement of obsolete machine tools.

The film on atomic power was produced for Westinghouse. Nearly 50 members and guests attended the meeting at Pontaluna Inn. —*Paul Thunfors*

HOUSTON—Some of the 160 Houston members who toured the Houston plant of Emsco Mfg. Co. on May 10 are shown. Standing are: Chairman J. W. Hindeman, Jr.; Samuel Martin, plant manager; and A. G. Meyer, Jr., chief tool engineer for Emsco.—*George Bo-Linn*

WILLIAMSPORT — A talk on analyzing manufacturing problems was given at the April meeting by Harry Conn, chief engineer at Scully-Jones and Co. Mr. Conn, center, shown here with a group of chapter members, was introduced by John Balint, who was in charge of the program along with William Paul and William McCoy. The welcoming address was made by Dr. George Parks, superintendent of Williamsport schools. — *Joseph B. Gehret*



Common goals were discussed by 25 men who attended the Rocky Mountain Conference at the University of New Mexico.

LONG ISLAND—Members of the Long Island chapter who toured Fairchild Camera and Instrument Corp. on May 9, get a closer look at a Fairchild aerial camera optical calibration pit. After the tour they adjourned to Wheatley Hills Tavern for a dinner and technical session. Three Fairchild engineers discussed aerial reconnaissance cameras and their use, photogrammetry and quality control function and environmental testing of aerial cameras. Speakers were: George Germaine, Stephen Einig and Robert Nelson.—*William H. Bruning*

Albuquerque Site of Rocky Mountain Meeting

Every year representatives of ASTE chapters in the Rocky Mountain Area meet to exchange ideas on improving program planning, membership, finance, educational and other chapter activities. This year's meeting was held May 7 with a conference breakfast at the Desert Inn Motel and all-day sessions at the University of New Mexico in Albuquerque.

Among those present were: Wayne Ewing of Los Angeles, national fourth vice president; Ralph L. Chrissie of Los Angeles, National Program Committee; Leslie C. Seager of Salt Lake City, National Professional Engineering Committee; and Clinton J. Helton of Denver, 1954-55 member of the National Membership Committee. Participating chapters included Albuquerque, Salt Lake City, Denver, Los Alamos, and Phoenix. Following the day's meeting a dinner was held at the Fez Club for representatives and their wives.

—*H. E. Anderson*

INDIANAPOLIS—A real thrill was in store for the young sons who accompanied their dads to the Indianapolis chapter's annual father and son night. They were photographed with several outstanding 500-mile notables who were guests of the chapter. Racing fans will recognize Walt Faulkner, far left; Bill Vukovich, back row, left, two-time winner of the rugged race; Frank Delroy, center; Andy Linden and Cal Niday, back row, right. (Editor's Note: As followers of the Indianapolis Race know, Mr. Vukovich met his death on May 30 in this year's 500-Mile Race.

Indianapolis Holds Father and Son Night

Father and son night, an annual event staged by the Indianapolis chapter, was held at the Sahara Grotto on May 5. A program with the central theme of automobile racing, was highlighted by a talk on "Fuels and Lubricants for Racing Engineers." The talk was presented by Raymond G. McMahan, automotive engineer for Socony-Vacuum Oil Co., Inc.

Other features of the evening were a color film covering the high points of the 1954 500-Mile Race at Indianapolis and the presence of several well-known 500-Mile-Race drivers. Nearly 120 attended.

—*Dorman B. Dickerson*

Joseph Karash Speaks at Springfield, Mass.

An audience of 60 members and guests of the Springfield, Mass., chapter was on hand for the April program entitled "A Method of Reasoning for Tool Design." Joseph I. Karash, production manager at Reliance Electric and Engineering Co. was the speaker. He was introduced by Technical Chairman Robert M. Dickson.

In his discussion, Mr. Karash outlined his 'sequence of decision" for the engineer's approach to a problem. The four points are: division of work; machine decisions; tool decisions; and justification of decisions.

A film on stretch-wrap forming, sponsored by Hufford Machine Works, was shown before the technical talk. Other meeting highlights included the presentation of the chairman's pin to Hollis B. Moore and a past chairman's pin to Peter F. Scott.

—Allen M. Johnson.

Professor Talks on Trend of Tooling

Prof. L. J. Schnitzer, vice president and director of research at Inland Engineering, Inc., was the guest technical speaker at Calumet Area chapter's May 9 meeting. In his discussion of "Trend in Tooling," Prof. Schnitzer traced the history of toolmaking from its beginning through present-day automation. Prof. Schnitzer is a member of the Chicago ASTE chapter. Sixty attended this meeting at the Cape Cod Inn despite a downpour.

—L. W. Montgomery

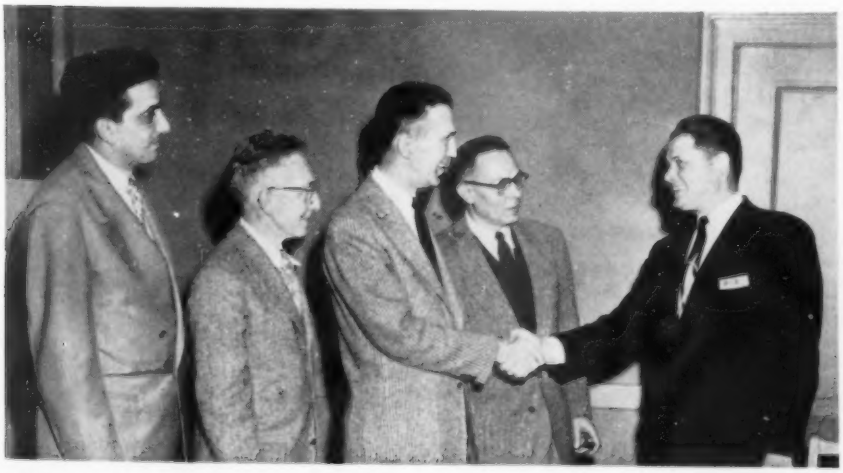
HAMILTON DISTRICT—Some 120 couples met in the Burgundy Room of the Fischer Hotel for Hamilton District's annual ladies' night. On behalf of the chapter, Chairman Frank C. Johnson presents a coffee pot to Mrs. John M. Snyder, wife of the immediate past chairman. Mr. Snyder and Mrs. Johnson look on.

Two Hamilton Members Receive TE Handbooks

Tool Engineers Handbooks were presented to Paul Ruhland and Stanley Paluck who headed their respective classes in night school courses sponsored by Hamilton District chapter. Courses were in die design and press metal engineering at the Delta Collegiate in Hamilton. Frank C. Johnson, chairman of the Hamilton chapter, made the presentations at the May 13 meeting.

The technical portion of the program featured talks and demonstrations on "do-it-yourself" electric tools. The program was presented by Campbell G. Ousley and H. R. Abrahams of Black and Decker Mfg. Co., Ltd.

—M. A. Marcellus



LEHIGH VALLEY—Walter Koenig, Lehigh membership chairman, congratulates four of five members who were responsible for securing nearly 63 percent of the new members recruited during the membership drive of the past year. From left are: Vincent Scalese, first vice chairman; Paul Gehris, secretary; Samuel Kuba, second vice chairman; Chauncey Kay, editorial chairman; and Mr. Koenig. George Kane, another member of the successful recruiting team and education chairman, was absent. Their efforts added 32 members to the roster.

D. G. Faust Addresses Fox River Members

Delbert G. Faust, vice president in charge of sales and advertising for the C. A. Norgren Co., addressed 50 members and guests of the Fox River Valley chapter on April 26. The meeting, held at the St. Charles Vets' Club, was devoted to "Micro-Fog Lubrication of Machine Tools."

On April 20 the chapter enjoyed a tour of the Scully-Jones & Co. plant in Chicago. *—Harold L. Smith*

Attracting More Industry Discussed at San Antonio

Industrial expansion in the San Antonio area was the subject of the May ASTE program. The speaker was G. White, secretary of industrial expansion at the Chamber of Commerce.

He outlined expansion possibilities and explained the functions of C of C committees on labor, marketing, facilities, financial facilities, product analysis, tax and legal programs and industrial publicity. The chapter's past chairman's pin for 1954-55 was presented to Edgar Measels. *—Stanley G. Gower*

Lehigh Members Tour Doehler-Jarvis Plant

Eighty members of the Lehigh Valley chapter journeyed to Stowe, Pa., for a tour of No. 2 Plant of Doehler-Jarvis Div. of National Lead Co. Preceding the tour, the group convened in the lecture room to hear a brief talk on construction, cost and capacities of the plant.

Speaking on behalf of the plant was Leonard Huff, Mechanical Division superintendent. He also discussed manufacturing methods and the products of the plant. "The Shortest Way," a film on aluminum die casting procedure at the plant, was shown.

Safeguarded with goggles, the men toured the plant in groups of ten with a guide and then enjoyed coffee and doughnuts in the cafeteria.

—Chauncey R. Kay

New Orleans Award Goes to M. P. Chatry

In recognition of his outstanding work and tireless effort for chapter expansion, M. P. Chatry was awarded the achievement pin of the New Orleans chapter. The presentation was a highlight of the April meeting. Principal speaker was Don Lawless of Cincinnati Milling Machine Co. who spoke on Hydroform. *—Joseph Natal*

Milwaukee Chapter Host to Madison ASTE Members

Guests at Milwaukee's May 12 technical session included many members of the Madison chapter who drove in from the state capital to attend the program on "Jigs and Fixtures for Hand Welding." Speaker was Hans G. Frommer, production manager at the Trackson, Co., a subsidiary of the Caterpillar Tractor Co. Also second vice chairman of the Milwaukee chapter. Mr. Frommer illustrated his discussion of basic principles of tool design of welding fixtures with a group of more than 50 slides. Examples of jigs and fixtures which have proved successful in production were also illustrated.

Frommer

—Walter Behrend

Appointment Announced

Collins Radio Co., Western Div., Burbank, Calif., announces the appointment of Joseph A. Parks as supervisor of its model shop. Mr. Parks was chapter chairman of the Los Angeles chapter and membership chairman of the San Fernando Valley chapter, his present affiliate.

BATTLE CREEK—Approximately 100 high school senior boys from the Battle Creek area toured the University of Michigan engineering college laboratories as guests of Battle Creek chapter, area industrial firms and the university. The group is pictured in front of the Union Building following a luncheon. Prof. O. W. Boston, chairman of the university's Production Engineering Dept. addressed the group on general phases of engineering education.

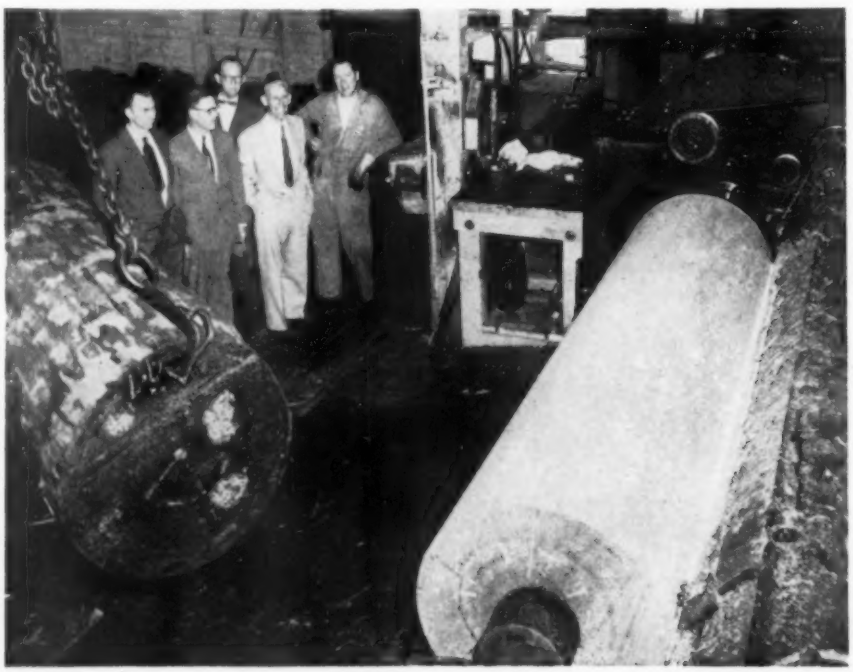
Metallurgical Engineers Address Battle Creek

Robert R. Ruppender and Allen B. Pagel, metallurgical engineers for the Ferrotherm Co., addressed 45 members of the Battle Creek chapter on May 9. With the aid of slides and a film, Mr. Ruppender and Mr. Pagel discussed heat treating and joining of metals with controlled atmospheres. More specific topics covered were heat treatment of air hardening tool steels, of stainless steels and metal joining by copper, as well as silver and nickel alloy brazing. *—Arthur F. Damon*

Conference Held by Erie Engineers Council

More than 200 attended the Engineering-Management Conference sponsored by Erie's Engineering Societies Council on April 19. The all-day meeting took place at the East Erie Turners Club. Participating in the conference were: ASTE, ASME, ASM, AWS, PSPE, IRE, SPE, ISA, and ASRE.

The program included "Industrial Design in the Product" by J. M. Little of Little Associates; "Electronic Data Processing Machines in Industry" by R. W. Desio of International Business Machines Corp.; "The Technique of Making Decisions" by Dr. C. West Churchman of Case Institute; "Administering the Idea to the Product" by J. F. Young of General Electric Co.; and "Stimulating Creative Thinking in Engineering Personnel" by R. K. Stolz of McKinsey and Co. *—D. J. Beecher*



SEATTLE — A continuous sheet of fir veneer peeled from a log five feet in diameter was a colorful sight on the tour of the U. S. Plywood Corp. made in April by 145 ASTE members. Pictured, from left, are: Dennis Nichols, industrial relation manager at the company; Frank Stasny, ASTE chairman; Harold Hanson, editorial chairman; Gordon Duncan, program chairman; and one of the firm's employees.—*Harold F. Hanson*

Steel Mill Visited by Springfield, Ill., Chapter

A tour of the Granite City Steel Co. was made in May by nearly 100 Springfield ASTE members and guests. The two-hour visit included the open hearth furnaces, blooming mill, slab furnaces, roughing mill, finishing mill and coiler, cold rolling and tin plating.

—Herman Hahn

Lansing Members Hear President Osborn Talk

Lansing chapter members numbering 50 met at The Country Kitchen to hear Harry B. Osborn, Jr., national ASTE president, on April 25. In his role of technical director, Tocco Div. of Ohio Crankshaft Co., Dr. Osborn discussed "Induction Heating for the Tool Engineer." *—Hal Buehler*

Pittsburgh Chapter Tours Fisher Body Division

With more than 175 members and guests taking part, Pittsburgh's May program took the chapter to Dravosburgh, Pa., to visit the Fisher Body Div. of General Motors Corp. Guides, assigned to small groups of five to ten guests, conducted the visitors through the plant, answering questions and explaining the manufacturing processes. The tour was arranged by Walter B. Kiefer, chairman of the chapter program committee. —*E. L. Caughey*

Kenneth Blake Presents South Bend Program

A talk on "Dynatomics" was given May 17 at a meeting of 65 South Bend members and guests. Program speaker was Kenneth R. Blake, president and technical director of Metalloid Corp.

Mr. Blake explained how tool geometry, feeds, speeds and coolants affect the molecular structure on the metal being machined. With the right combinations of these elements, he said, the atomic structure of a material is arranged in such a manner as to allow freer machining.

—*Dave Herring*

Film Presented at Portland, Ore., Meeting

A film on high-speed turning with wax cutting fluids was shown to Portland members attending the May 19 meeting. It was presented by D. D. Harader of the S. C. Johnson and Son Wax Co. who conducted a question and answer period after the showing. In April the chapter toured the Electric Steel Foundry, one of the largest in the West.

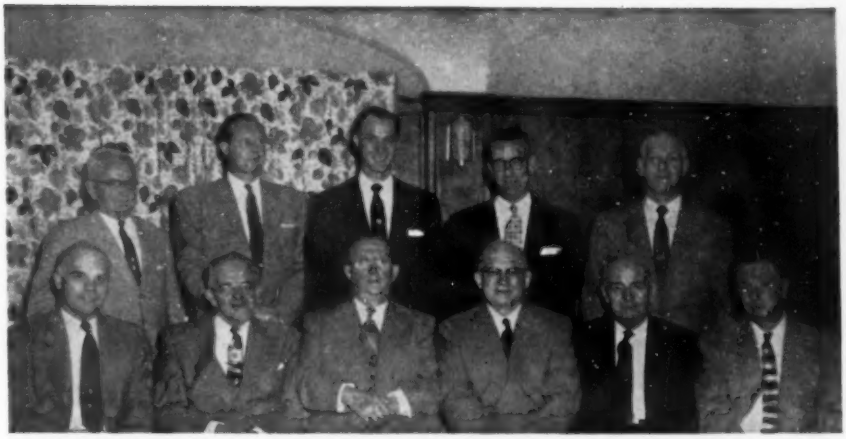
—*Walter L. Brenneke*

Discussion on Presses Given at Muncie Meeting

Howard F. Sherman, district manager for the E. W. Bliss Co., was the speaker at Muncie chapter's May 3 meeting. His presentation on the application of presses to present industrial needs was illustrated with movies. Other program notes for the meeting held at the Delaware Hotel include a report by Carl Darger on the Purdue University on-campus conference.

In April chapter members heard a talk on multiple spindle drilling and tapping operations by Frank Zagar, president of Zagar Tool Inc.

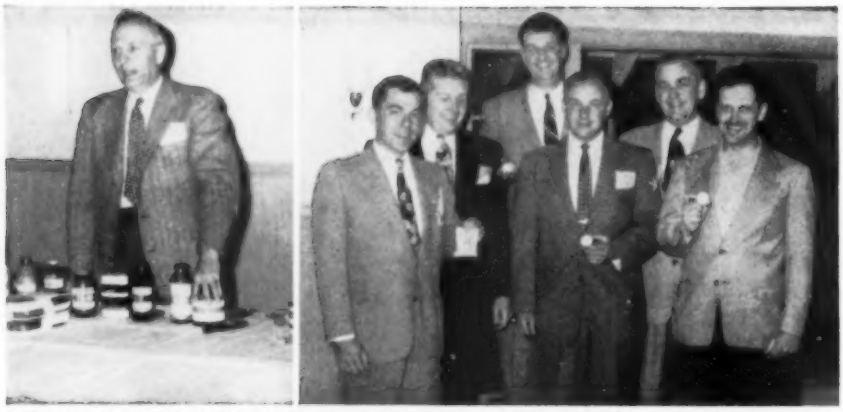
—*Darrell Marks*



ROCHESTER—Past chairmen of the chapter were honored at the meeting held May 2. Present for the program, staged by Arthur Argtries of the Consolidated Vaudeville Exchange, were: (back row) William Gordon, Charles DeMartin, Donald Kohler, and James Horne, a national director of ASTE. Front row: Gerald Sick, Milton Roessel, Cecil Lucus, Charles Codd, Herbert Simmonds, Earl De Bisschop, and Charles Seeley. Past director awards were presented to Mr. Codd and Mr. Lucus by Chairman William B. Kamola.—*Floyd Weed*

PORTLAND, ORE.—Ben J. Hazewinkel, a national director of ASTE, installs ASTE officers of the Portland chapter. From left: Fred L. Allen, chairman; Robert C. Erickson, first vice chairman; Prof. Milton C. Sheely, second vice chairman; Edward S. Reilly, secretary; and Walter L. Brenneke, national delegate. The technical program that night was sponsored by Lindsay Bros. and presented by George Dolan of Kennametal, Inc.

TOLEDO—Special emblems were awarded in May to four chapter members honoring them for their service to ASTE as members of the board of directors. Presented by R. C. W. Peterson, far left, third vice president, the emblems went to: Lorence Rennell, Samuel W. Burgess, A. M. Schmit, and Herbert L. Tigges. Technical speaker at the meeting was George M. Rice of Ren-ite & Renaud Plastics, Inc., who spoke on plastic tooling.—*Harold H. Krueger*



GREATER LANCASTER—Speaker at the May 10 meeting of the Greater Lancaster chapter was J. P. Guyer, Jr., pictured at left, regional supervisor, Industrial Products Dept., S. C. Johnson and Son, Inc. He discussed "Metalworking with Wax" for 60 members at the Media Heights Country Club. Preceding the dinner meeting some members enjoyed a golf outing. Pictured at right are the winning athletes: Ted Morrison, Robert C. Ressler, George Atherholt, William Goldback, Elvin Zimmerman and "Pip" Wilcox.—*Norman Ressler*

NEBRASKA — A tour of the Continental Can Co. plant in Ralston was on the March 24 agenda. ASTE visitors, including Sam L. Grasso, Adolph W. Beghardt, F. W. Conover, Elmer V. Larsen and Herbert K. Brow who are pictured here, were conducted through the plant by Adolph Schptaz, master mechanic. In April the chapter heard a tauk on lubrication by Guy A. Pence of Lincoln Engineering Co. and saw a film on die casting produced by the American Zinc Institute.

—*Dean W. Roper.*

WESTERN RESERVE — Chapter officers were installed by Andy Clark, center of front row, a national director of the Society. Pictured, standing from left, are: Ray F. Beatty, Jr., chairman; Eugene Helfer, first vice chairman; Edwin McCabe, second vice chairman; Fred Hartenstein, third vice chairman. Seated: Eugene Boron, secretary; Mr. Clark; and Karl Stephens, treasurer.

A. R. Sparrow Discusses Automatic Screw Machine

More than 100 Northern Massachusetts members and guests met May 17 to hear a talk by Alfred R. Sparrow, director of screw machine sales for Brown & Sharpe Mfg. Co. He spoke on automatic screw machines and tooling applications.

Covering the technical knowledge required of supervisory personnel in setting up screw machines, Mr. Sparrow emphasized the need of thorough knowledge of cams of all types in order to machine and produce parts as specified in drawings.

Properly prepared routings are also a top necessity. From there on, any good operator can produce parts in quantity, he said.

An extra attraction for this last meeting of the season was a musical program featuring Adolph Suihkonen and Paul Blaisdell.

Presentation of a *Tool Engineers Handbook* was made to George Stanley for his efforts in obtaining the largest number of new members for the chapter. —*Otto S. Nau*

A. S. Black Speaks at Des Moines Meeting

Technical engineer for the Fellows Gear Shaper Co., A. S. Black was the guest speaker at the April 20 meeting of the Des Moines chapter. He presented three films explaining the theory of gear development, applications of principles and numerous case histories of both spur and helical gears.

In addition, Joe Riding of Keystone Engineering and Mfg. Co., "gimmick session speaker," introduced a gimmick on stop pins for dies. Chairman T. H. Houke related some of his experiences at the ASTE Annual Meeting in Los Angeles. Approximately 50 attended this meeting at the Hotel Kirkwood. —*John Willing*

Western Reserve Award Goes to Charles Ramsey

Honored for his outstanding service as head of the chapter's program committee, Charles W. Ramsey is the recipient of Western Reserve's distinguished award pin for 1954-55. The presentation was made at the chapter's installation meeting in March.

Guest speaker at the program was E. C. Franklin, dean of engineering at Youngstown College. Presiding at the installation was Andy Clark, member of the ASTE board of directors. Another guest was Frank Flannery of the National Membership Committee.

Binghamton Members Hear Max Garber

Regional manager of the eastern region of Consolidated Engineering Corp. Max Garber was the guest technical speaker at Binghamton chapter's May 4 meeting. Mr. Garber talked on "Machine Tool and Vibration," discussing means of tracing and measuring with the aid of instruments.

Lee St. John, chairman of Binghamton's professional engineering committee, then presented some ideas on professional registration. Forty-eight attended the meeting at Vestal American Legion Hall. *—Glyn Williams*

Three Representatives Present Madison Program

William Cummings, W. E. Hart and Lyell C. Tullis, all representatives of Gilman Engineering and Mfg. Co., spoke before 90 members of the Madison chapter at Hoffman House on April 21. The presentation included films on automation for the fuse industry.

—Lyding A. Havey

Members of Louis Joliet Hear William Leser

After a smorgasbord dinner at the Woodruff Hotel, members of the Louis Joliet chapter heard a talk by William F. Leser, plant manager of the American Can Co. on April 19. Following Mr. Leser's talk, the group of 145 adjourned to the American Can Co. to tour facilities at the plant where they also saw the film "Miracle of the Can."

—Ken Hanks

CANTON—W. E. Curtis, center, chairman of the Canton education committee, presented student memberships to six local high school students at the April 28 meeting. From left they are: Donald C. Blend, Richard J. Herbst, Eugene L. Ritchie, John Dottavio, George J. Ilves and Phillip D. Marshall. "Machine Tool and Vibration" was the subject of a technical talk given by John J. McDonald of Consolidated Engineering at this meeting held at the Swiss Country Club.—*Clifford C. Smith, Jr.*

GRAND RIVER VALLEY—A dinner dance at the Leisure Lodge on May 6 brought out more than 250 members and guests of the Grand River Valley chapter for an evening of dancing and fun. Enjoying the festivities are, from left: Treasurer and Mrs. Grant Johnstone, First Vice Chairman and Mrs. Clayton Henderson, Past Chairman and Mrs. Percy Barber, Chairman and Mrs. Joseph Strite, Third Vice Chairman and Mrs. Percy Bowman, and Secretary and Mrs. Roy Robertson. *—W. C. Little*

LOUIS JOLIET—After the May 17 technical program on "Plastics, the Rising Star of Industry," participants pause to have a picture taken. From left are: Francis E. Bowers, chairman; Wallace Sinclair of Bakelite Co., Ross Marshall, technical chairman for the evening; Robert Klees, main speaker, assistant to the advertising manager, Bakelite Co.; and Ray Richards of Bakelite Co.

Carbide Tooling Discussed at Meeting

At the May 12 meeting of the Benton Harbor-St. Joseph chapter, Sy Dworecki spoke on "Carbide Tooling." Mr. Dworecki, Chicago district manager for Wesson Tool Co., discussed using the proper tool for job and low cost grinding per piece part in comparison of other types of tools.

Newly appointed chapter committee chairmen are: Harold Berk, constitution and by-laws; Orvis L. Johnson, editorial; Fred Lindenmayer, membership; C. C. Larsen, standards; Robert H. Potter, program; Alfred P. Nelson, public relations; Andrew L. Sokal, education; Marvin Cook, professional engineering; Norman Smith, historian; Calvin L. Frappier, advertising; and Oscar Lassfolk, chaplain.

—Orvis L. Johnson

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It saves you money these 8 ways...

- automatically positions cutting edge on center, saves "set-up" time.
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The exclusive V-R elevator provides an adjustable base for the insert . . . saves down time, makes indexing or changing inserts a quick, simple operation. Only the V-R patented elevator permits the use of any length of carbide, including "Throw-Away" blanks. Regardless of carbide length, the cutting edge is always on-center. The replaceable and reversible tool steel elevator is ground to provide a firmer base for the insert and, at the same time, locks the insert solidly in the toolholder. Ask your V-R representative to show you how the patented elevator of the V-R Toolholder can save you money, or write for details and the New V-R Toolholder catalog.

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PROGRESS IN PRODUCTION

HELICAL GEARS PRODUCED BY BROACHING

Helical external gears are produced by broaching through a process developed by General Broach and Engineering Co. Now well past the experimental and pilot run stage, several successful long production runs have been made.

Although not practical for short production runs because of initial tooling cost, it is an economical process for runs of 50,000 gears or more. In such runs, the creators of the process state that broaching costs will run considerably lower than hobbing. Accuracy and finish are comparable to the results of other gear production methods. Minute surface ripples inherent in hobbed gears are, of course, completely absent from the broached parts.

For production cost figure purposes, it may be noted that at a plant operated by General Broach for gear production, production rates of 20,000 finished gears per day per machine are not uncommon—the figure depending on specifications of the gear being produced.

In operation, machines are automatically loaded and at least one part is finished at every pass of the broach. In specific instances, it has been possible to complete up to eight gears with a single broaching stroke. Tool design is an adaptation of pot type broaching which allows quick replacement of individual broach teeth. As the blanks pass through the center of the broach, they are guided only by the broach and teeth and need not be center piloted.

SEMICONTINUOUS VACUUM FURNACE BEGINS OPERATION

More than 120,000 pounds of specialized vacuum melted alloys will be added to the nation's capacity with the output from the first semicontinuous vacuum furnace now in operation at Carboloy Dept. of General Electric Co.

The new 960-cycle furnace, which has a capacity of 1000 lb, can handle specialized heats of 100 to 1000 lb, and is capable of producing two 1000-lb heats per shift. Its normal cycle is five hours per melt.

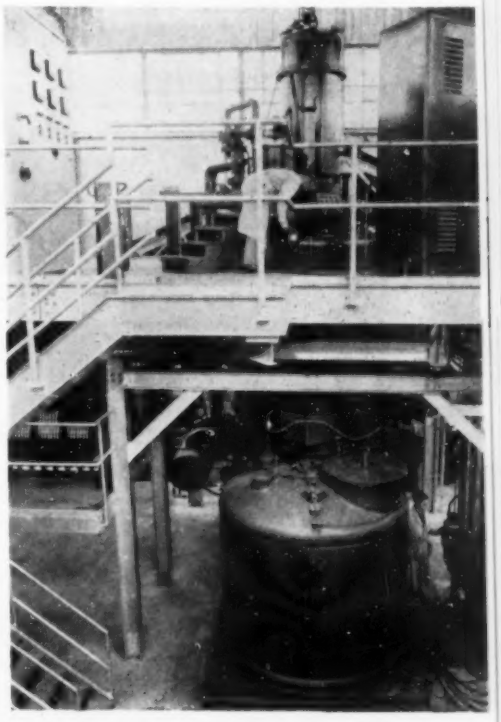
Outstanding feature of the furnace is the three vacuum chambers—a vacuum chamber for charging, the vacuum furnace, and a vacuum bell containg four ingots for pouring. There also is a vacuum chamber for additives. Because of this design, the furnace remains in continuous vacuum. At no time during charging or pouring is it necessary to break it; the vacuum drawn is less than 1 micron pressure.

Primarily, this pilot commercial facility is expected to provide engineers and designers with alloys possessing superior physical properties and consistency. In fact, the improved properties may justify new classifications of the resultant alloys.

With the operation of this new melting furnace, three basic problems in producing steels have been at least partially overcome. These handicaps were: effects of oxygen and nitrogen in the melt; effects of reactive materials; and presence of dissolved gasses which have previously been impossible to remove.

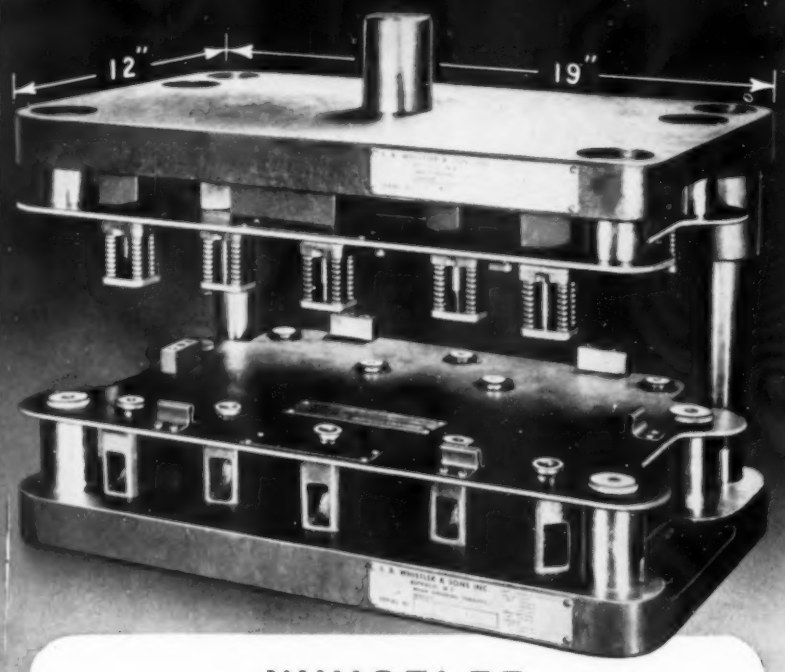
Although products from the furnace possibly will cost five to ten times those produced conventionally, for special high-temperature alloys the method is competitive.

This installation, along with others currently in operation in this country, will provide engineers with metals alloyed with sizeable percentages of elements such as titanium and zirconium.



Overall view of the furnace shows three components: charging chamber at top, melt chamber (partially hidden by flooring) and mold chamber below.

SPECIAL INTRODUCTORY UNIT



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ONE MAN OPERATES ENTIRE STAMPING LINE

Use of automatic devices and conveyors has created a manufacturing line at Signode Steel Strapping Co. which requires only a single attendant. Production of the line is six stamped steel plates used by shippers to secure steel strapping to walls and floors of freight cars.

Work starts with passing of coiled strip through an automatic press for blanking and forming. Formed plates drop on a conveyor, are carried to a de-oiling tank to be washed by mechanically agitated detergent solution kept evenly heated by thermostatic control. A second conveyor carries pieces out of the tank, and they drain and dry of their own heat as they travel on a third conveyor, from which they drop into an accumulator pan.

Two tumble blasting units of different load capacities are operated to surface finish pieces; five of the stampings are blasted in loads of 500 pieces, the sixth in loads of 1000. Pieces destined for each machine are automatically counted out by a mechanism on the punch press. A timer synchronizes movement of the accumulator pans with the press so that batches are kept separate. The pans then drop each set of 500 pieces into a bucket loader for the shot blaster. The operator controls that loader electrically. However, once loaded, the blasting operation, too, is automatic. When its cycle is complete, the machine unloads itself into a shipping box.

CUTTING FLUID CHOICE AFFECTS TOOL LIFE

Experimental studies involving the effect of cutting fluids on tool life during machining of titanium metal have provided interesting results pertinent to tool economy. Comprehensive tests conducted by Carbide and Carbon Chemicals Co., a division of Union Carbide and Carbon Corp., indicate that tool life in machining titanium with a synthetic, water soluble cutting fluid increases as much as 300 to 500 percent, as compared to similar operation in which heavy-duty solubilized oils are substituted.

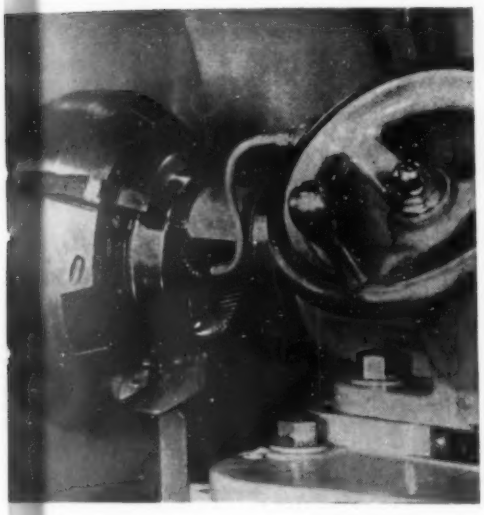
In these experiments, Ucon cutting fluid H-660 in a 1 to 5 dilution with water was used in turning and parting Ti 150 titanium test rings with carbide tip tools.

Other tests, conducted by an Eastern engineering school on friction between sliding metal surfaces, showed that the coefficient of friction for the synthetic lubricants also is considerably lower than for conventional cutting fluids.

PLUNGE-CUT PROCESS FOR INTERNAL GEARS

A process for plunge-cut rotary shaving to produce crown-shaved tooth surfaces in internal spur or helical gears has been developed by National Broach & Machine Co. The tooth shape resulting from the method is like that of the elliptoid tooth form. Usually teeth are slightly thinner at the ends than at the center. Maximum tooth thickness zone can be positioned either side of center if desired.

The crowning features, which in tooth thickness variation amounts to only a few tenths of a thousandth of an inch per inch of tooth face width, avoids



tooth end bearing caused by minute errors or gear deflections under load.

The process makes use of a specially developed rotary gear shaving cutter and new plunge-cut in-feed techniques. The internal gear to be shaved is mounted on the workhead of a conventional internal gear shaving machine. Then the cutter is meshed with the gear and hand fed against a stop to position the cutter in correct axial location with the gear. The shaving machine workhead is then rotated with the cutter in mesh with the work. The cutter is fed up to depth in predetermined increments with no cutter reciprocation, permitting the cutter to form a crowned tooth surface while simultaneously finishing the gear tooth surfaces.

Internal gears produced by this method have the same advantages of reduced noise level and increased wear life as external gears having the crowned tooth form. Production of gears by the new process, with or without the crowning features, has been found to be considerably faster than by conventional methods.

NEW PLATING TECHNIQUE PREVENTS CORROSION

Deposits of chromium which provide corrosion resistance plating superior to conventionally applied plating are being achieved through a production process called "Crack-Free Chromium." It is applied directly on steel without necessity for an undercoat of nickel or copper and nickel to protect the base metal as is normally required.

The new plate is deposited free of structural imperfection that would allow corrosive materials to filter through to the underlying surface. Ordinary chromium coatings of decorative thicknesses contain pores varying in number with plating conditions. As the deposit thickness increases, the number of pores decreases but a cracked structure develops and continues regardless of the increase in thickness. A photomicrograph of a cross-section of metal conventionally plated more than 0.0001-in. thick will show cracks extending through the deposits.

By comparison, a photomicrograph of a cross section of steel plated by the Crack-Free chromium process will show a dense, continuous structure.

The process, developed by United Chromium, Inc., is done with a special chromic acid type bath having automatic regulation of the catalyst concentration. Standard plating equipment and procedures are used. A single compound is dissolved in water in proper amount to prepare the plating bath.

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Model 50-DD

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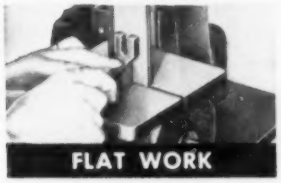

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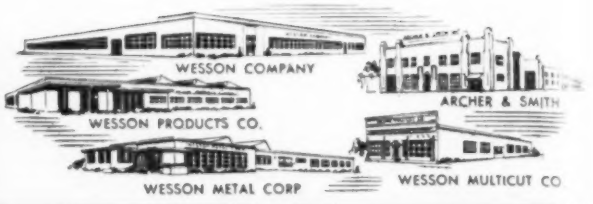
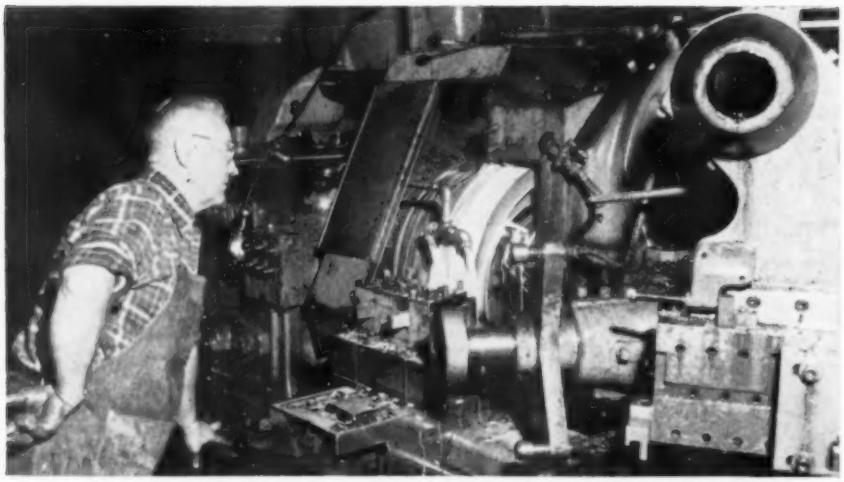
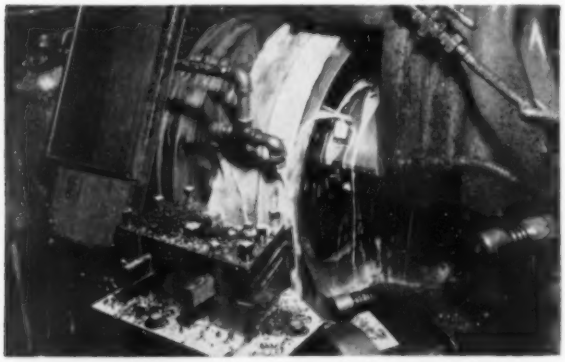


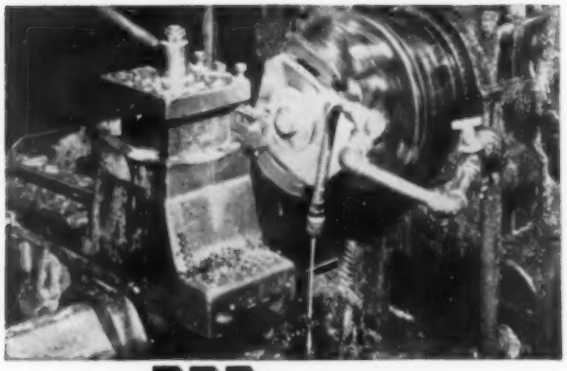
New Grade 26 Nearly Universal



Straddle facing the O. D. of a forged steel final drive gear on a 4F Gisholt Fastermatic lathe using Wessonmetal Grade 26. Tool life increased 40% over other carbides.



Closeup of straddle facing operation. Two solid carbide Grade 26 inserts are used. Job is being done at 260 sfm and 40 rpm. Feed varies from .017" to .020" with average depth of cut from 3/16" to ¼".



Grade 26 produced a 30% increase in tool life on a severe interrupted cut on a tractor brake band anchor. Standard Wesson band-type Multicut is used on a Warner & Swasey turret lathe. Cutting speed ranges from 280 sfm down to zero. Feed is .027", depth of cut is ⅛".

tools Wesson carbide Wessonmetal

Useable on 95% of steel cutting operations, it boosts tool life 40%

The nearest approach to a universal cutting grade available to the metalworking industry is a new carbide designated as "Grade 26" by Wesson Metal Corporation. Created primarily for all types of steel rough and semi-finish machining, it is also proving highly effective on some finishing operations.

Problems of carbide selection are greatly simplified by Wessonmetal Grade 26, since it cuts down the number of grades required for steel cutting operations by as many as four grades.

Optimum performance for Grade 26 extends over a range of 100 to about 400 sfm, covering 95% of steel machining operations encountered in industry today.

Much of Grade 26's record of outperforming all other steel cutting grades in 95% of all machining operations on which it has been applied is due to its superior edge cutting strength. Grade 26 was developed to have high red hardness and high thermal conductivity in order to function without any drop in performance at the elevated temperatures generated at high cutting speeds.

Improvement in tool life over all other grades has averaged about 40% on applications to date. Extensive tests have been conducted on a wide range of materials ranging from conventional steels to the high alloys used in high temperature applications.

Now in full production at Wesson Metal Corporation's new metals plants in Lexington, Ky., Grade 26 provides the answer to lower tool costs over a broad range of metal cutting operations.

For answers to your machining problems write:
WESSON COMPANY
DEPT. AD
1220 Woodward Heights Blvd.
Detroit 20, Michigan.

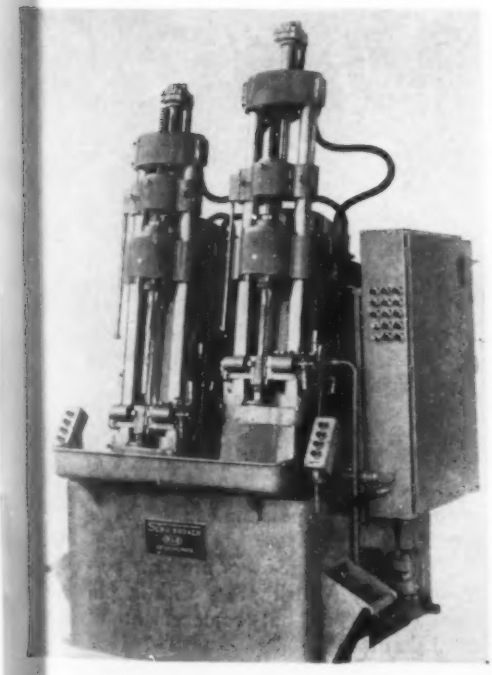
TOOLS of today

Threading Machine

A production machine for difficult threading operations in large nuts, especially those having fast leads, has been developed by Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich. Such parts as lead nuts and nuts for circulating ball type screw assemblies can be threaded quickly and accurately on this machine, called the Scru-Broach.

It is designed to work with a special type of broaching tool that has the appearance of a tap, but the cutting action of a broach. This tool is easily sharpened by grinding the faces of the teeth in the flutes. The teeth are not form-relieved, and can be sharpened repeatedly without changing the size or form.

The Scru-Broach is built with one, two or four work columns, depending on production requirements. A hydraulic system provides pressure for clamping the work, actuating the tailstocks and positioning the fixtures. **T-7-1451**



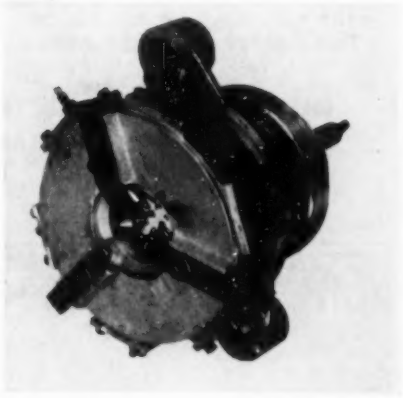
Milling Head Attachment for Drill Presses

Multiple splines, spiral flutes, squares, hexagons and other odd shapes can be cut at production rates on any standard drill press with a milling head patented by Modern Mfg. Co., Edgemont and Clementine Sts., Philadelphia 34, Pa. The head cuts from 2 to 12 splines within commercial tolerances in one operation in about three minutes per finished piece.

It may be used either as a single unit or in series on multiple spindle lathes or presses in a vertical, horizontal or angular position. Straight or spiral splines may be milled in either direction at a maximum or minimum pitch.

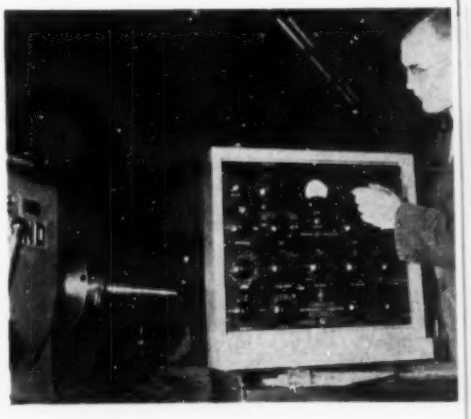
From 2 to 12 cutters are used in the head and are adjustable to accurate micrometer settings from the outside.

While this model has a capacity for $\frac{5}{8}$ to $1\frac{1}{4}$-inch diameter stock, special models to handle up to 5-inch diameter stock are available. **T-7-1452**



Machinability Computer

An electronic machinability computer, developed by Carboloy Dept. of General Electric Co., Detroit, Mich., enables the user to determine the correct set of conditions for machining a given job. Computations are made in less than two minutes with consistency and reasonable accuracy. It considers up to 14 operational variables in machining such as grade of carbide, speed, feed, depth of cut, tool life, alloy, material hardness, etc. If fed information on any 13 of the variables, the machine provides the correct answer for the



The parts are all made and on their way. Now I can go on my vacation thanks to you Pete and your favorite Columbia ATMODIE.

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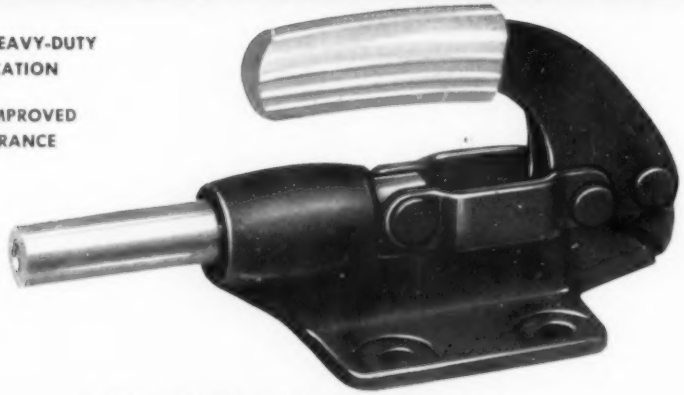
- FOR IMPROVED APPEARANCE



RED HEAD'S *PUSH-PULL*

Has traditional RED HEAD quality features—malleable cast iron base, external head rivets, extra long barrel for greater strength and accuracy, steel-on-cast-iron for better friction surface, etc. Available in two sizes—Model PP-4 (illustrated above) with 400 lbs. recommended delivered pressure, and Model PP-8 with 800 lbs. recommended delivered pressure.

(Write for detailed specifications, Catalog B-122)

CASE-MAUL MANUFACTURING CO.
22 HARKER ST., MANSFIELD, O.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-146

missing fourteenth.

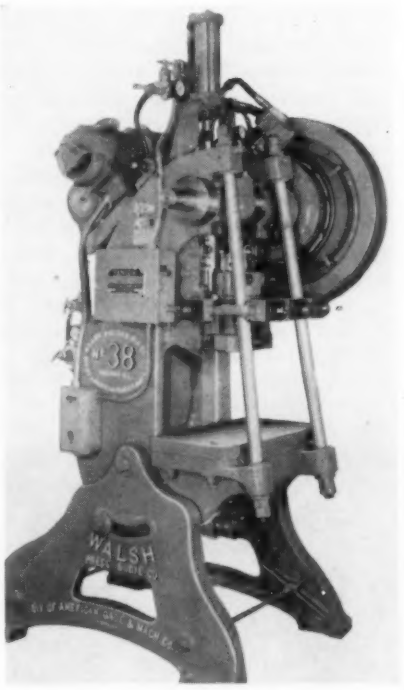
In addition, the unit is designed to consider five variables affecting motor horsepower required to do a machining job. For this information too, it provides an accurate answer for the one unknown when fed information on four of the variables. **T-7-1461**

USE READER SERVICE CARD ON PAGE 165 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Presses

Air-Clutch Hi-Flex O. B. I. presses have been added to the press line made by Walsh Press and Die Co., Div. American Gage and Machine Co., 4709 W. Kinzie St., Chicago 44, Ill., to further increase production in the stamping field.

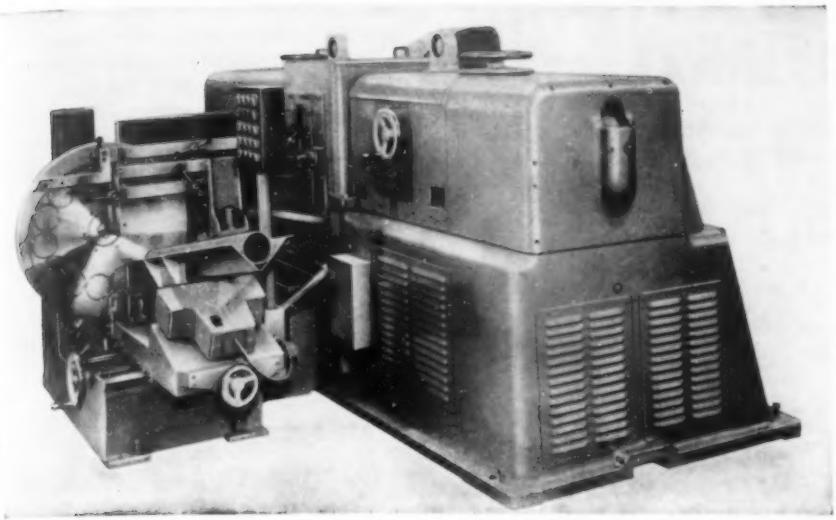
Special feature of the line is the electric-pneumatic control which may



be set on inching, single stroke or continuous operation, at high or low speed, with the possibility of stopping the press at any position of the slide. Drive speed is variable.

An air balancing unit cushions the slide movement on top and bottom of stroke, and also prevents the slide from dropping, due to possible connection or pitman failure.

Air-clutch change-overs are now possible on any Walsh press with a pin type clutch, without replacement of crankshaft. **T-7-1462**



Grinder

A double horizontal spindle grinder designed for greater accuracy and high production has been announced by Besly-Welles Corp., Beloit, Wis.

This grinder, the Model 240, is equipped with Besly's sealed spindle quill construction—heads are completely sealed, which prevents wear and also permits smooth, accurate adjustment of the abrasive disks, and avoids transmitting motor vibration to the spindle.

All controls, motors, starters and hydraulic units are enclosed within the machine base. Controls are automatic and are accessible from either side of the grinder. Individual dressers for each disk are push-button operated.

High-speed feeding is by means of an electromagnetic pick-off disk which supplies work to the grinder in a continuous stream. **T-7-1471**

Diamond Tools

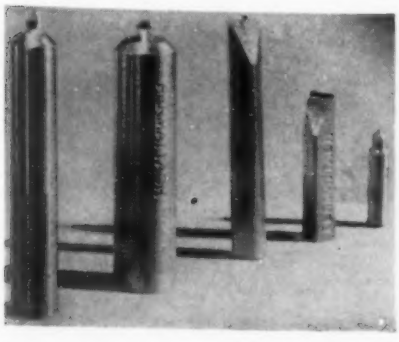
A line of industrial diamond tools, with mountings originally developed by General Electric Co. and perfected by Permattach Diamond Tool Co., Inc., has now been placed on the market.

This mounting provides maximum utilization of the stone without remounting because the diamond is united chemically to the tool shank instead of being deeply embedded in the shank.

Security of the setting is not weakened by normal pressure or friction and there is no danger of stone pop-off.

The line includes various type dressers and shaped and lapped diamond tools. They also are made to customer specifications.

Permattach, Milford, N. H., is the sole manufacturer under the G-E process. **T-7-1472**



D-C Welder

The Controlarc, a magnetic amplifier-rectifier D-C welder with full-time automatic arc control, is being produced by Vickers Electric Div., Vickers Inc., 1815 Locust St., St. Louis 3, Mo., a unit of the Sperry Corporation.

Available in 200, 300 and 400-amp. models, the Controlarc automatically

Modernair

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Easier to apply . . .

Compact, versatile; choice of 3 mountings and 7 manual, solenoid, cam or pilot operating means for pneumatic, hydraulic systems to 200 p.s.i.

Easier to install . . .

Sub-base, console and panel, or conventional piped mountings available. Made in ⅜", ½", ¾" and 1" NPT port sizes.

Easier to service . . .

Only moving part is one-piece spool carrying all moving seals which are standard "O" rings stocked by industrial supply houses; replaceable in minutes—no springs or retainers.

4-way double solenoid MV is only 9¾" x 3½" x 2⅝" overall (½" NPT ports); handles to 150 p.s.i.

Lever-operated MV valve body with ½" NPT ports is only 4" x 3½" x 2⅝". Handles to 200 p.s.i.

Don't lose time and money with misfits or specials when a stock MODERNAIR MV valve will do your job. Modernair valves, cylinders and parts are stocked in principal U.S. and Canadian cities, and at factory. For prompt delivery, call your authorized dealer or write us now for specifications and prices.

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INDICATE A-7-147

Linde FLAME-PLATING NEWS

News of another successful use of LINDE'S process for applying a tungsten carbide coating to metal parts.

Flame-Plated plug, ring, and air gages have extra-high wear resistance for long-lasting accuracy.

Flame-Plated Plug Gages Outwear Carbide Gages 3-1 . . . Hard Chrome Plated Gages 20-1!

Flame-Plating, a LINDE Service for depositing a thin coating of hard, wear-resistant tungsten carbide on metal parts and many tools, continues to be used with highly successful results on plug, ring, and air gages. The wear-resistant tungsten carbide coating, applied in LINDE's Flame-Plating plant, gives gages lasting accuracy through a longer wear life. Flame-Plated plug gages, for example, have actually outworn solid sintered tungsten carbide gages 3 to 1...hard chrome plated gages 20 to 1.

TEMPERATURE COMPENSATION PROBLEMS REDUCED

Flame-Plated gages have the same coefficient of thermal expansion as the gage base metal. When the gage base metal is similar or identical to the part being gaged, temperature compensation problems are either greatly reduced or eliminated entirely.

CHIPPING AND BREAKAGE PRACTICALLY ELIMINATED

Flame-Plating a gage with tungsten carbide produces a hard, wear-resistant surface while retaining the toughness of the base metal. Thus, the problem of breakage is greatly minimized especially on small diameter gages. The tungsten carbide coating is also highly resistant to chipping. These factors are important advantages over solid sintered carbide gages.

AVAILABLE NOW AT LEADING GAGE SUPPLIERS

Flame-Plated plug, ring, and air gages are now available in standard AGD sizes. Plug gages from .059-in. up. Ring gages from .375-in. up. Ask your gage supplier how you can cut inspection costs with Flame-Plated gages or call the LINDE office nearest you. Send for your free copy of the Flame-Plating booklet today.

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and continuously adjusts the selected arc characteristics to every change in welding condition, from arc strike to end of pass. The welder provides easy clean arc strikes, hot starts, immediate penetration, uniform fusion and steady rate of metal deposit. It is designed to prevent arc "pop outs" and current drop-off during pass.

There is separate and complete control of both voltage and current, making it possible to set up any volt-ampere combination within the output range of the unit. **T-7-1481**

Hardness Tester

The Mark VI Penetrascope metal hardness tester, announced by the Tinius Olsen Testing Machine Co., 143 Easton Rd., Willow Grove, Pa., offers accurate testing of both ferrous and nonferrous metals of a wide range of sizes, shapes and contours. A variety of clamps make it possible to test specimens ranging from metal strips only 0.002 in. thick to cylinders over eight feet in diameter.

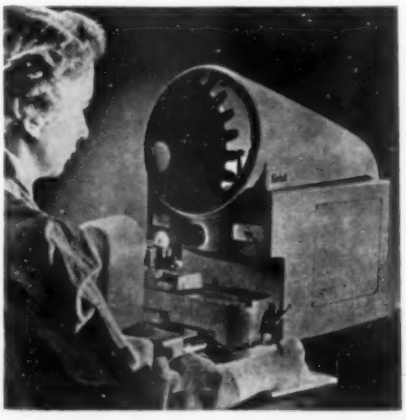
Extreme accuracy is obtained in the 16 to 800/1000 diamond pyramid hardness range (from softer than 0 R_B to 64/69 R_C), with excellent comparative results obtainable up to 1500 diamond pyramid hardness (75 R_C).

Light and compact, the Penetrascope is easily transported and fastened directly to parts of any size. **T-7-1482**

Portable Contour Projector

A portable bench-type Kodak contour projector has been designed for economical checking of small parts with the same degree of precision obtained with larger units. Lenses yield a bright image and permit use of the projector anywhere in the plant. Whether used horizontally or vertically, the projector always produces an erect right-reading image.

Six magnifications (10, 20, 31¼, 50,



62½ and 100x) are provided, with all lenses quickly interchangeable and positively seated for the precise, rated magnification.

Relay lens system gives ample, uniform working clearance at all magnifications. Changing from one power lens to another does not affect clearance.

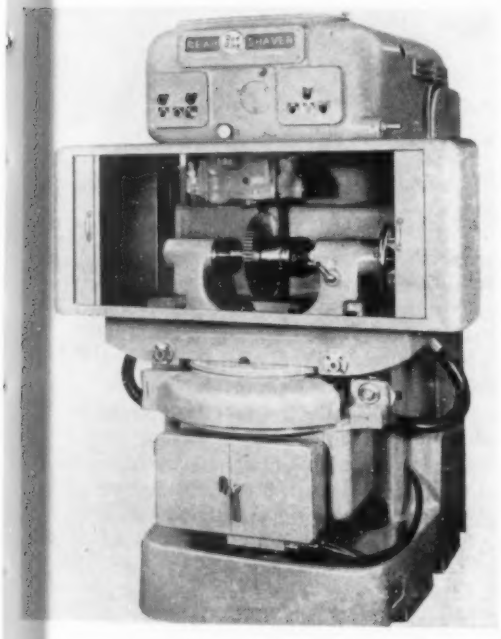
The air-cooled lamphouse and simple, handy controls assure operator ease.

This contour projector, Model 8, is the fifth in the current line manufactured by the Eastman Kodak Co., Rochester, N. Y. It is distributed by Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N. Y.

T-7-1491

Gear Shaver

External spur and helical gears up to 18-in. diam are finished by either diagonal or conventional shaving processes with the Red Ring rotary gear shaving machine available from National Broach & Machine Co., 5600 St. Jean Ave., Detroit 13, Mich. This Model GCU-18-in. is offered in three different types to shave gears: (1) by the high production diagonal process; (2) by either the diagonal or conventional process, with an automatic differential upfeed mechanism; and (3) by either convention or diagonal process, with an automatic differential upfeed mechanism, and which further permits crown shaving operations.



Any of the units will shave spur and helical gears from 2¼ to 18-in. pitch diameters having 4 to 16 diametral pitch teeth. The table has a maximum stroke of 5 inches. **T-7-1492**

Tungsten Boring Tips

Tungsten carbide rotary boring bits that provide efficient performance at low cost are being manufactured by Armstrong Products Ltd., Old Cobden Mill, Wrexham, Denbighshire, Wales.

Design gives a positive rake on the cutting leg which brings about considerably increased speed of penetration. Streamlining of the body reduces boring resistance, while the scientific proportionment of dimensions allows rapid chip clearance. **T-7-1493**

Automatic Tapping Tool

Keller Tool Div. of Gardner Denver, Grand Haven, Mich., has developed an automatic tool, the Airfeedtapper, that features controlled thread-cutting for the high-speed production of clean, accurate threads with minimum tap breakage.

The Airfeedtapper has adjustable torque control to enable maximum permissible torque to be delivered to the tap. Adjustable feed rates permit the advance to be set for best cutting with

Precision drilling and reaming requires bushings. When you are called upon to build or service a jig or fixture you need bushings right at hand. A shortage at a critical time can cause lost production.

ACME representatives maintain stocks of over twenty thousand ASA and ACME standard size bushings in many strategically located major industrial areas. You need only phone or wire the ACME office nearest you for immediate delivery.

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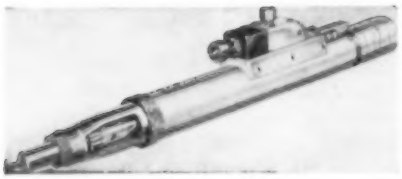

a particular tap size, and the return set for a slower rate to prevent damage to the entrance thread as the tap is withdrawn.

A microdepth adjustment permits blind-hole tapping. The advance can be held to within one-quarter thread, and the tap will automatically back out when the desired depth is reached. A four-way valve is used to control the tool from any remote station.

Forward and return poppets are built into the tool to allow jog tapping when working on hard metals or compositions. **T-7-1501**

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Electric Indexing Table

Black & Webster, Inc., 445 Watertown St., Newton 58, Mass., has introduced an electric indexing table for automatic work-positioning featuring a central column on which tools may be mounted. The table is available both as a packaged unit with the company's electric impact hammer (Electropunch) which stakes, rivets or marks automatically with the cycling of the table

or, separately, for use with other automatic tools.

Completely self-contained, this all-electric table has a built-in automatic timer which is continuously adjustable from 6 to 54 indexes per minute and automatically triggers the tools when the table locks in position.

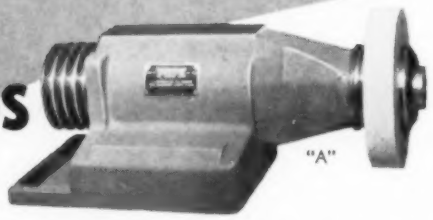
Specifications for the unit are: height of table above bench, 8 in.; shut height of Electropunch spindle above table, with 12-in. column is 4 in.; throat is 4 in.; weight of unit less Electropunch head is 82½ lb. The 15-in. table will take eight 3¾-in. diameter station fixtures. Time for motion during one index is 0.693 sec. Repeat accuracy is 0.001 in.; no backlash can occur. **T-7-1502**

Automatic Honing Unit

Superior model "SA" automatic honing machine has been announced by Superior Hone Corp., 1612 Elreno St., Elkhart, Ind. The machine, which requires a single operator, is of single spindle construction with a two-position fixture which can be loaded or unloaded while one piece is being honed. After each honing cycle, an automatic air gage built into the honing

Specify POPE

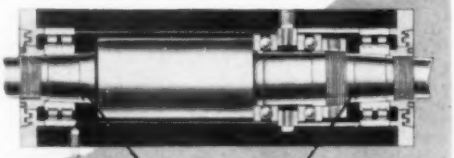
HEAVY DUTY WHEEL HEADS



Note the big precision bearings and the big shaft. A pair of precision thrust bearings stabilize the shaft against any axial movement in either direction. (No end play)

The double row cylindrical roller bearings carry the radial loads with ease and at low temperature.

"B"
Power-Max 25 HP—available with standard No. 30, 40, 50 or 60 milling machine noses.



Send us your specifications and ask for New Bulletin S-8

Taper mounting provides for precise individual preloading of the radial bearings.

POPE Heavy Duty Wheel-Head Spindles are designed for a wide variety of applications such as grinding, boring, milling, drilling and many other opeartions requiring PRECISION COMBINED WITH RUGGEDNESS in the spindles.

For continuous production and trouble-free operation THERE'S NOTHING LIKE A POPE SPINDLE WITH ROLLER BEARINGS.

BOOTH NO. 117

No. 94

Specify POPE PRECISION SPINDLES

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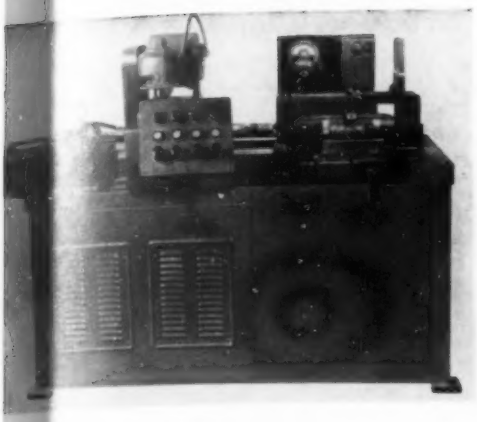

mandrel moves into the bore and gages the part just honed.

Movement of the honing head, fixture and air gage is hydraulically controlled.

Other than loading and unloading, the entire operation is push-button controlled from a central panel.

A built-in electric timer allows variable cycling for efficient operation.

T-7-1511

Balancing Hoists

Horizontal, dual-load balancing hoists have been designed by The Platz Co., Inc., 20433 Sherwood Ave., Detroit, Mich. These counterparts to the company's vertical units are available in six models with capacities for loads from 20 to 325 lb. High and low pressures, applied by a hand control, are utilized to completely neutralize loads so that they can be quickly and easily moved into position in a precision fixture.

The dual-load balancing hoist is constructed to operate on a 4 or 6-inch standard I-beam, or can be furnished to operate on any type rail. Standard balancing range is 42 inches. **T-7-1512**

Drill Sharpening Kit

Quick, easy and accurate drill sharpening may be accomplished by even unskilled workers with the Swanson drill sharpening kit, introduced by Swanson Mfg. Co., 1236 Sherman Ave., Evanston, Ill.

The kit consists of a drill grinding attachment which holds the drill to be sharpened in a sliding V block (for twist drills from $\frac{1}{8}$ to $\frac{3}{4}$ in.); a rocker plate, which enables the user to shift the drill back and forth between strokes to equalize wheel wear and reduce burning; a heavy metal base, 12 x $10\frac{3}{4}$ x 3 inches, equipped with metal drawer for storing the drill grinding attachment and other accessories when not in use; and a 3-way drill point gage, 4

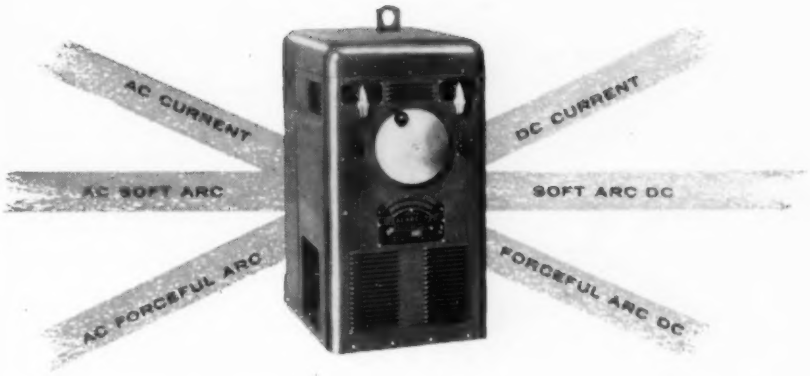

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FIGURE THESE FACTS:

1. Idealarc welding is easier, faster. On AC welding you have the smoothest, most stable arc ever known—*plus*—choice of soft-arc and forceful arc on every job... to give you top speed.

2. Idealarc handles all your jobs AC and DC. You can standardize on *one* machine for all production welding. You can buy Idealarc as an AC-DC machine . . . or as a straight AC welder to which a DC unit can be added at any time.

GET THE WHOLE STORY. Write for Bulletin 1343.

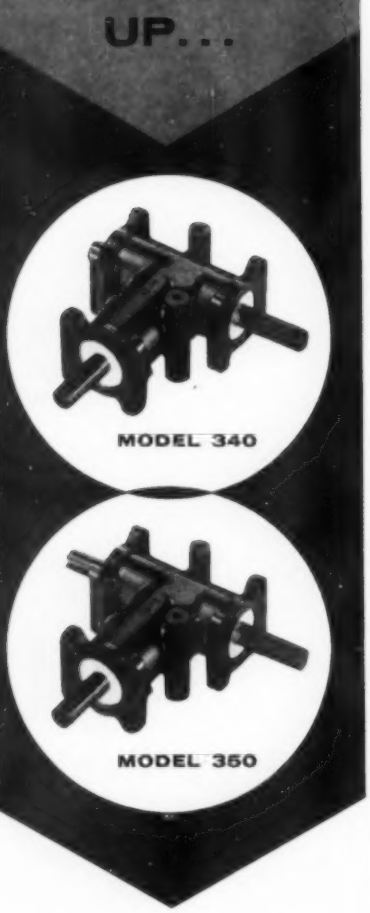
THE LINCOLN ELECTRIC COMPANY

Dept. 5003 • Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-151

ANGLgear Horsepower UP...



...but price stays down!

3 hp at 1200 rpm! That's the new rating of the rugged 2 and 3-way ANGLgear models shown above. And — we repeat — there is no change in purchase price.

The expanding ANGLgear line — now including 1/3, 1 and 3 hp units available with 1-1 or 2-1 gear ratio and with either 2 or 3-shaft extensions — enjoys wide acceptance in many fields. It's sold only through your local distributor. See our literature in the product design section of Sweet's Catalog.

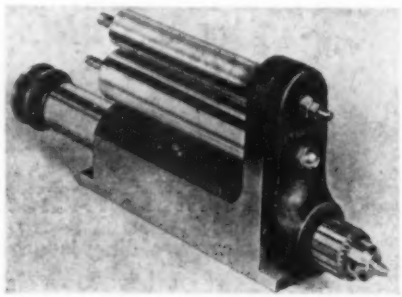
AIRBORNE
ACCESSORIES CORPORATION
HILLSIDE 5, NEW JERSEY
INDICATE A-7-152

inches in length with calibrations and moving angle pieces, that checks the angles ground and also serves in selecting the right drill for the work in hand.

The kit has been designed especially for 6-inch bench grinders with wheel spread up to 15 inches, and 5 to 5 3/8 inches from base to center of spindle. Other sizes can be adopted by blocking up grinder or rocker plate. **T-7-1521**

Drilling Unit

Engineered for simplicity and versatility, this precision drilling unit, called the Lynmatic 101, has been developed by Lynco Inc. and is being distributed by Burklyn Co., 3429 Glendale Blvd., Los Angeles 39, Calif. The



drill head includes an adjustable hydraulic feed control that permits rapid traverse. The unit can drill to 2-in. centers and in double row ball thrust bearings.

Square sides and bottom parallel to the spindle simplify alignment of the drilling unit on either single or multiple setups. Used in conjunction with the Lynco automatic control box and cycle timer, the unit will perform step drilling, peck drilling, etc., correctly drilling holes up to ¼ in. in almost any material. **T-7-1522**

Embossing Dies

Mikay Co. is utilizing a new meth to produce economical embossing di that will mark steel, aluminum, bra copper or wood to critical specificatio Engraving may be done on die ma rials as hard as 70 R_C. The process pe mits cost from 25 to 50 percent belo normal.

Either entire plates or inserts can b made by the company which is equipped to provide as fast as 48-hour delivery i specific cases. Dies may be made t emboss round, square or other odd shape pieces. They also may be produced to any dimensional requirements and have been made up to 8 x 48 inches.

Details are available from the company, P. O. Box 5933, Cleveland, Ohio, or its agents, W. R. McDonough and Co., 508 Terminal Tower, Cleveland, O. **T-7-1523**

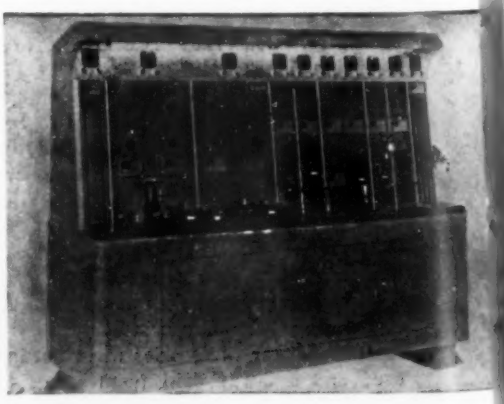
USE READER SERVICE CARD ON PAGE 165 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tool Control Unit

An aid to automatic machine operation has been developed by Royal Design and Mfg., Inc., Center Line, Mich., in the form of Cy-Co-Trol tool control units. Installed next to the machine it is to control, the unit works automatically once it is set.

Based on past experience, the average life expectancy of each tool can be set into the control unit in terms of machine cycles. A cyclemeter for each tool records the number of machine cycles. A yellow bulb lights when a tool approaches its last 10 percent or last hour of useful life. A red bulb lights, indicating the tool that needs replacement, and the machine is stopped when any tool has reached its preset limit.

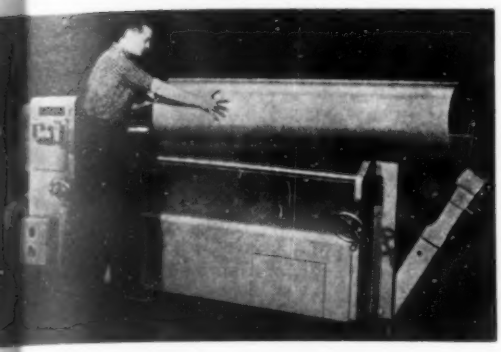
Storage space is provided in the control unit for two complete sets of properly adjusted tools and adapter assemblies. Standard and special gages used with the machine can also be kept in the control unit. **T-7-1524**



Roll Forming Machine

Available in a wide range of power and hand-operated models, a new line of slip roll forming machines, made by Niagara Machine & Tool Works, features pinch type rolls to assure production of commercially true cylinders virtually free from flat spots.

Two of the rolls feed the material. The third, in the rear, deflects the sheet to produce the curvature. The upper feed roll, around which the sheet is formed, swings open at one end,



clear of its bearing, to permit completed cylinders to be removed quickly and easily.

Working with lengths up to 120 in. and of up to ¼-in. thick mild steel, Niagara slip roll formers are used in diverse applications to form cylindrical, oval and rectangular products.

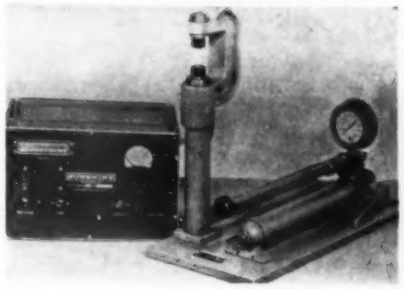
Built in heavy, medium and light capacities with 6, 4, 3, 2, 1½ and 1-in. rolls to handle general requirements, standard units can be outfitted with special attachments for particular classes of work, quantity production and other purposes.

Descriptive literature, Bulletin 77D, covering the complete line is available from the company, 683 Northland Ave., Buffalo 11, N. Y. **T-7-1531**

Portable Indicator for Surface Resistance

Effectiveness of a cleaning process used to prepare metal for resistance welding can be tested by the portable instrument developed by Sunshine Scientific Instrument, 1810 Grant Ave., Philadelphia 15, Pa. Accurate measurement of the resistance between two pieces of metal is accomplished in seconds. Designed for use with any resistance welding application, it is particularly useful with aluminum welding.

The equipment consists of a microhmmeter and a sample holder. The microhmmeter has two ranges of 0 to 200 microhms and 0 to 2000 microhms. The measured resistance is indicated directly in microhms on a linear 100-division scale and is unaffected by voltage fluctuation The microhmmeter may be used as a separate instrument. The sample holder provides a simulated electrode force up to 4300 lb. It consists of a hydraulic ram with pressure gage, and includes two current and two emf electrodes which are so spaced as to make measurement independent of sample size. **T-7-1532**



Deep-Throat Press

A 15-ton 15-inch deep-throat press, a companion to the Model 15 standard, is announced by the Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles, Calif.

Designed for fast precision stamping, with deep-throat features, it gives minimum down time and long service life.

Construction features include a solid one-piece alloy-steel crankshaft. There is no need for slots in the crankshaft because the driving mechanism is self-contained in the clutch collar. Pin diameter is 2⅜ inches. The 200-lb flywheel is 20 inches in diameter and is fitted with a companion drive which serves as a virtually indestructible driving plate. The press frame, extra strong and rigid, is of the multiple-rib design. The ram hole is 1⁹⁄₁₆ inches, accommo-

Efficiency in Cutting-off is Important

Practically all machining operations start with pieces cut-off from bars or billets. Hence, inefficiency, or lack of capacity, in the cut-off department can hold up or stagnate the entire plant.

A. Are all-ball-bearing and provide a quick return; therefore they run FASTER than others on the same work.

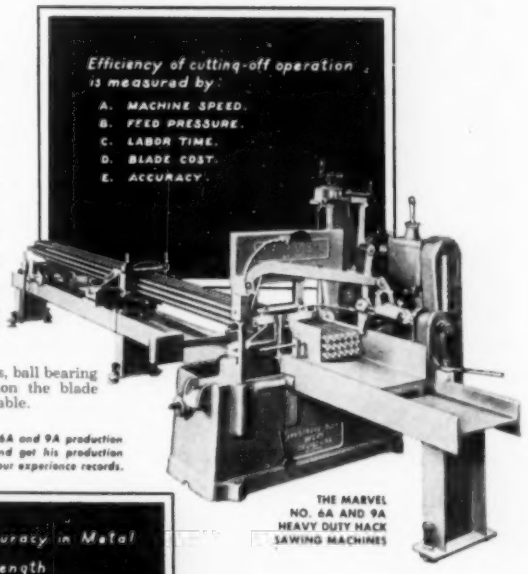
B. Can apply as much as 1200 pounds feed pressure—two to ten times as much as other hack saws and band saws.

C. Are fully automatic, requiring no more operator attention than an automatic screw machine; and set-up for any bar size and cut-off length is extremely simple.

D. Use a non-breakable high speed hack-saw blade — the type of saw blade that produces the greatest number of square inches of metal cut per dollar of blade cost—two to ten times (or more) as much as any band saw.

E. Because of their exceptional sturdiness, ball bearing reciprocating frame, ability to tension the blade "truly taut", their accuracy is dependable.

If you are not using modern, improved MARVEL NO. 6A and 9A production hack saws, call the local MARVEL Field Engineer and get his production and cost estimates on your work—to compare with your experience records.



THE MARVEL NO. 6A AND 9A HEAVY DUTY HACK SAWING MACHINES

Formula for Accuracy in Metal Sawing:
ACCURACY = (Length, Straightness, Squareness)
Straightness, Squareness) = (Blade Rigidity, Blade Tautness
MARVEL
HIGH-SPEED EDGE
ARMSTRONG-BLUM MFG. CO.
CHICAGO 22 MADE IN U.S.A.

The composite MARVEL High-Speed-Edge Hack Saw Blade—cuts **any** machinable material efficiently. There is no time lost changing blades for different types of steel; no time lost replacing shattered blades, because MARVEL High-Speed-Edge Hack Saw Blades are positively **unbreakable.** These superior blades have the finest high speed steel cutting edge welded to a strong alloy steel body. They will stand-up under the highest speeds and heaviest feeds attainable on any make hack saw. Can be safely tensioned tauter than any other blade—cut-off not only straight but also square and with less stock loss.

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

Write for catalog C-55—showing and describing eleven different series of Metal-Cutting Sawing Machines and MARVEL High-Speed-Edge Hack Saw Blades and Hole Saws.

MARVEL SAWS
Metal Cutting
Sawing Machines—Sawing Blades

ARMSTRONG-BLUM MFG. CO. 5700 West Bloomingdale Avenue • Chicago 39, U.S.A.
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-153

dating standard die sets. Ram area, front to back and right to left, is 4 x 5 inches. Distance from center of ram to back of press is 15 inches. The bolster plate is 11 x 14 x 1¼ inches.

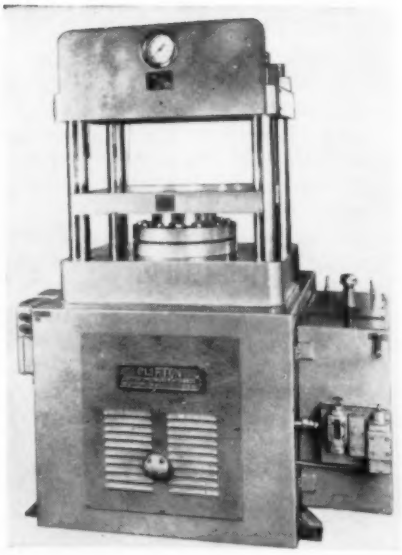
Equipped with Kenco's single-trip control, there is no lost motion; it provides safe and positive single-trip action, and requires only one to two lb operation pressure.

The Kenco 15-ton deep-throat press is a floor model only. It can be furnished in single or double-hand control or foot control. It is solid-backed, but has the inclinable feature. **T-7-1541**

Hydraulic Press

Clifton Hydraulic Press Co., 288 Allwood Rd., Clifton, N. J., has announced a self-contained all-purpose Model 3A hydraulic press, designed particularly for duty in heavy production schedules. It utilizes a power return and has sturdy construction.

The press, available in tonnage capacities of 50, 100, 150 and 300 tons, is equipped with Clifton's special control unit governing the hydraulic circuit, the Unitrol®, developed to avoid piping and plumbing, and provide



single control for operation.

Optional equipment available includes either steam cored or electrically heated platens and a semiautomatic unit for presetting time cycles.

T-7-1542

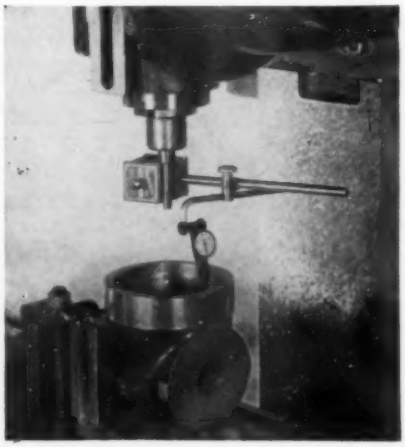
Magnet-Base Indicators

A testing stand called the Magnicator, announced recently by Brown & Sharpe Mfg. Co., Providence 1, R. I., includes several features designed to make the tool convenient to use.

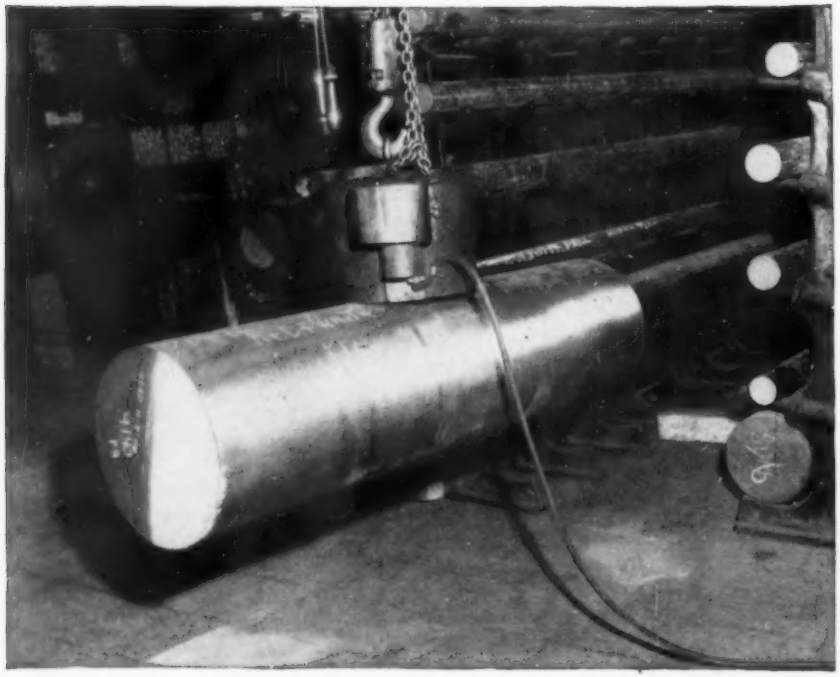
Magnetic force in the stand's permanent magnet base is fully releasing and may be turned on and off by push-button control.

It can be used on any magnetically conductive surface and in any position —upright, horizontal or upside down. It has three flat energized surfaces, the bottom of the base and the two sides. An additional V surface on the top of the base holds to round surfaces for making tests from spindle to table or from spindle to work.

The small, lightweight tool is designed to accommodate Brown & Sharpe



Walker Does It Again-



The strongest lifting magnet pound-for-pound ever made. Complete saturation . . . maximum efficiency . . . minimum wattage. Shown here—WALKER magnet lifting, with *12'' line contact*, solid steel cylinder 13.5'' diameter, weighing 2200 pounds, and utilizing about the same wattage as your kitchen lamp.

WALKER magnets lift up to 50,000 pounds.

O. S. WALKER CO. Inc.

WORCESTER 6, MASSACHUSETTS

Original Designers and Builders of Magnetic Chucks

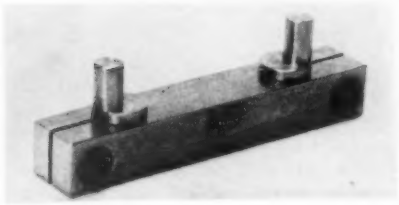
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-154

dial attachment No. 725 in a range of 0.030 by 0.001 inch, and No. 725A with a range of 0.008 by 0.0001 inch. It can be used with other indicators as well.

The Magnicator is furnished in three different ways: No. 742 without indicator; No. 742-1 with a No. 725 dial attachment; and No. 742-2 with a 725A dial attachment. **T-7-1551**

Versatile Gage

Adjustable pin or button-type gages to measure both inside and outside of both cylindrical and rectangular parts, is announced by Ames Instrument Co., Concord, Mass. Designed to replace numerous special gages in the shop, the



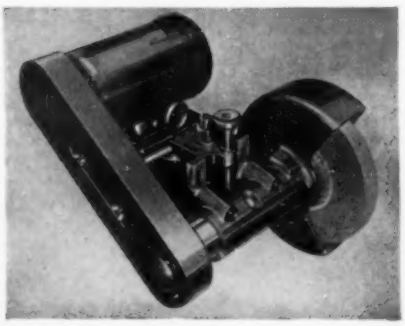
tools, called Snappergages, are useful for measuring recessed hard-to-reach places, groove width and spacing, hole location, concentricity and shoulder lengths.

They are available in standard sizes with 30 handles or frames and 5 gaging buttons providing inside measurement from 0.100 to 3.500 inches and outside measurement from 0.000 to 3.400 inches. **T-7-1552**

USE READER SERVICE CARD ON PAGE 165 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Tool Post Grinder

A 3-hp tool post grinder for heavy-duty cylindrical and surface grinding is offered by Dumore Precision Tools, Racine, Wis. Powered by a constant speed induction motor, the Series 25 swings wheels up to 12 in. in diameter



for SUPERIOR DESIGN

use... Hydro-Line CYLINDERS

SERIES "J" CYLINDERS

for rugged, trouble free service

- *CARTRIDGE . . . rod-wiper, packing, bushing in one unit.*
- *RUGGED BODY . . . all steel end caps and barrel.*
- *PISTON RINGS . . . step-cut joint, sealing in both directions, long life, minimum leakage.*
- *PRESSURE . . . 2,000 psi heavy-duty . . . 3,000 psi non-shock.*
- *SIMPLICITY . . . no tie-rods . . . no retainer rings.*

Write for Bulletin No. 53

Hydro-Line Manufacturing Co.

5668 PIKE ROAD • ROCKFORD, ILLINOIS

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-155-1

HAVE YOU A PUMP PROBLEM ?

Illustrated is a Storm-Vulcan #75 Camshaft Grinder on which Ruthman Gusher Coolant Pump is standard equipment.

Ruthman CAN SOLVE IT FOR YOU

If you have a centrifugal pump problem, we can help you solve it. As originators of the motor driven machine tool coolant pump, Ruthman has developed many types of centrifugal pump applications including coolant pumps, agitators, molten metal pumps, etc. Send us complete information on your pump requirements, perhaps one of our many models with slight modification will solve your specific problem.

THE RUTHMAN MACHINERY CO.

1810 READING ROAD CINCINNATI, OHIO

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by 1½-in. face, at speeds of 1750 rpm.

The Series 25 is designed for mounting on lathes 20 in. or larger, planers, shapers, vertical boring mills, etc. to convert them to precision external grinders.

Quill is 3 in. in diameter. At 1750 rpm bearings have a radial capacity of 955 lb and a thrust capacity of 655 lb.

Center line of spindle to center line of mounting post is $3^{37}/_{64}$ in. Quill adjusts vertically 1⅝ in. for quick wheel centering by turning handwheel. Operating weight is 176 lb. **T-7-1561**

Honing Machine

Hand honing of the outside or inside diameters of parts ranging from ⅛ to 1-inch diameter, may be accomplished with the Model No. 5 which has been added to the line of machines manufactured by Staple Engineering Co., 1315 S. Woodward Ave., Birmingham, Mich.

Spindle speed, which may be changed while the spindle is rotating, can be infinitely varied through the speed range of 160 to 1600 rpm by an electronic speed control operated by a small lever. A ½-hp motor and eddy current clutch drive the spindle.

A foot pedal control releases the brake, starts the spindle and feeds the honing stones out to an adjustable preset stop.

Honing tools and abrasives are supplied by Staple Engineering Co. for use in this machine and these are assembled into the machine spindle ready for use without the need of wrenches or other tools.

Adapters are used to hold the various size honing tools to prevent wear in machine spindle. **T-7-1562**

Bulk Pallet Container

Paltier Corp., 1701 Kentucky St., Michigan City, Ind., has developed the Paltier canvas container for handling bulk solids while saving on handling costs.

The canvas container collapses flat with the base when not in use. When

Now See the Entire Collection of

"Award-Winning" Kling Metal Fabricating Machines in this New Bulletin 100

In the new Kling Bulletin you will find illustrations and data representing over 50 Kling Machines. These versatile machines, performing scores of metal-working operations, are winning "Production Oscars" for thousands of companies throughout the world. It is the increased production . . labor-saving . . . cost-cutting results from Kling machines that account for their increasing use in "the best of companies." Such results as shown here* can be yours. We will be glad to send you a list of users in your industry, along with your free copy of the new Complete Line Bulletin 100. Why not send for it today?

A **KLING DOUBLE ANGLE SHEARS** *One Chicago manufacturer reports that this machine is cutting his labor costs 75%

B **COMBINATION SHEAR, PUNCH & COPERS** *A large railroad shop reports that this "jack-of-all-jobs" gets 16 hours' work from an 8-hour shift

C **HIGH SPEED FRICTION SAWS** *A famous midwest manufacturer reports that one of these saws cuts 1000 to 1300 channels, angles, round and flat bars, every 8-hour day

Since 1892

Kling BROS. ENGINEERING WORKS
1320 N. KOSTNER AVE. • CHICAGO 51, ILLINOIS
Makers of Friction Saws; Shears—Rotary, Double Angle and Guillotine; Punches; Combination Shear, Punch and Coper; Angle and Plate Bending Rolls; Bulldozers.
Export Distributor: Simmons Machine Tool Corp.
50 E. 42nd Street, New York 17, N. Y. 997TE

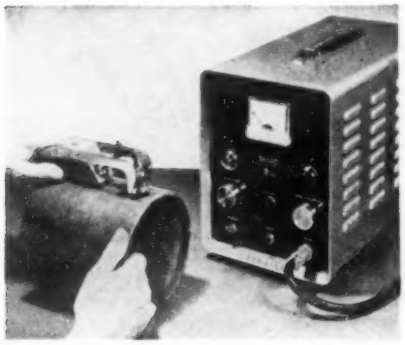
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-156

tiering posts are set up, the canvas is raised to form a bulk container. Furnished in canvas, duck, water resistant materials, rubber or plastic material, it is available with zipper, straps, or other type closures for protection of contents; or with open top with hook-on type container.

Standard sizes of the container, which is supplied with aluminum or steel base and tiering posts, are 32 x 40 x 24 in. and 40 x 48 x 24 in. **T-7-1571**

Crack Measuring Device

Magnaflux Corp., 7300 W. Lawrence, Chicago 31, Ill., has introduced the Sedac SE-100 seam depth indicator which both detects and measures nondestructively the depth of cracks from 0.012 to 0.120 inch deep. Deeper cracks can be detected but not measured. It is a portable electronic instrument weighing only 15 lb. The sensing element is a scanning probe on a ten-foot scale. Relatively symmetrical parts can be scanned automatically. In other cases hand scanning is more practical.



By comparison with a known sample, the SE-100 can be calibrated to find only cracks deeper than a preselected allowable minimum. It can be used on flat pieces and curved surfaces with a 3½-inch or larger radius.

The Sedac is used on relatively clean surfaces and offers a completely reliable nondestructive means for rapidly indicating which cracks should be removed in salvage operations. Thus salvage and material costs are reduced and inspection interpretation problems are eliminated. **T-7-1572**

Table Feeds for Bench Millers

Air-operated hydraulically controlled table feeds have been developed by the U. S.-Burke Machine Tool Div. for the four models of its bench millers.

These millers can be equipped with either 16 or 20-inch long tables and on either table an 8-inch stroke air motor can be used, together with an 8-inch stroke, hydro-check valve and suitable limit switches, transformers and solenoid valves.

The air-hydraulic fed table is adaptable to a wide range of applications including milling, sawing, facing, slotting, etc., and provides unusual speed, accuracy and economy of operation. Distance and speed of the rapid traverse approach, the cutting feed and length, and rapid automatic return are variable to suit particular job requirements.

Literature describing the feeds are available from the manufacturer, Dept. TI, Cincinnati 27, Ohio. **T-7-1573**

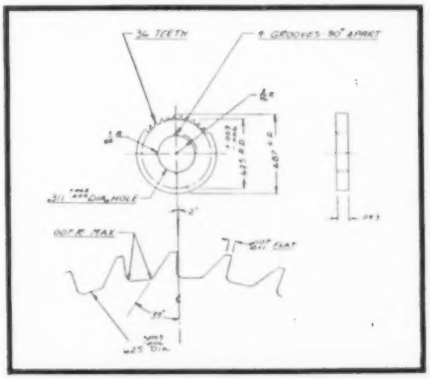
Cutting Machine

Abrasive cutting machines, called Speed-Cut, for cutting all shapes and types of materials, are now being marketed by Beaver Pipe Tools, Inc., Warren, Ohio. High-speed abrasive wheels are used to cut through soft or hard metals quickly and easily, leaving a smooth surface. Thin-walled steel aircraft tubing, soil pipe, galvanized steel, angles, structural members or solid bars are cut efficiently.

Classified as No. 14 and No. 20, the machines have the following capacities: A No. 20 with a 20-in. cutting wheel

Gaertner OPTICAL INSTRUMENTATION

to measure and check parts like this



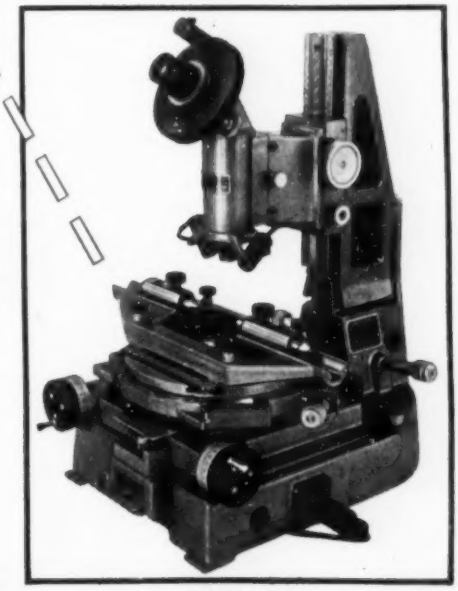
Use the Gaertner Toolmakers' Microscope

FEATURING

Range	2" x 4"
Reading to	.0001"
Stage Rotation	360°
Reading to	1 minute
Magnification	30X
Protractor Ocular	

ACCESSORIES

Templet Ocular Head
Radius and Thread Templets
Camera Attachment
Magnification 10X to 100X



M2001ARS

Write for Bulletin No. 147-50

The Gaertner Scientific Corporation

1241 WRIGHTWOOD AVENUE CHICAGO 14, ILLINOIS

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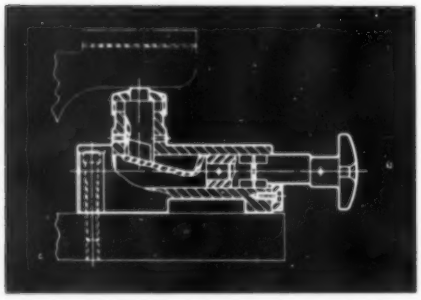
Lower Cost Greater Speed

•

Why go through the costly motions of making your own jig and fixture parts? **Lodding** mass-produced line is as handy as your nearest Lodding distributor —in all industrial centers— to meet your every need.



Lodding Heavy-duty Jack Assembly is the modern way to support work while machining. Makes obsolete makeshifts like screw jacks and shims. Made in three sizes.

Fast . . . . positive . . . . accurate.

Design and build fixtures and jigs with the Lodding catalog at your elbow. The savings will make you happy.

Lodding INC.
84 BEACON ST., WORCESTER 1, MASS.
THE STANDARD LINE OF JIG AND FIXTURE COMPONENTS

INDICATE A-7-158

and a wheel speed of 2300 rpm can sever a 6-in. pipe or a 2½-in. solid rod or bar. A No. 14 with a 14-in. wheel and a wheel speed of 3000 rpm can cut 4-in. pipe or a piece of 2-in. solid rod or bar. An 18-in. wheel can also be used on the No. 20.

On the No. 20 unit, a quick-acting, foot-controlled chain vise holds material, while the No. 14 has a hand-operated chain vise. **T-7-1581**

USE READER SERVICE CARD ON PAGE 165 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Carbon Remover

A practical, efficient carbon remover, called Multisol, has been developed by Brulin and Co. to combine effective action, maximum safety and speed. Multisol is noninflammable, free of caustic, noncorrosive to aluminum, brass, zinc, tin plate and magnesium, and will remove practically any soil or finish from metal.

Multisol is a two-layer liquid for use in dip tanks. The upper layer is a floating seal to prevent escape of solvent vapors, reduce drag-out loss of material and to rinse the parts as they are removed from the solvent.

The lower layer is a combination of solvents, penetrating agents and emulsifiers formulated to break the bond between metal surface and carbon, paint, grease and gums. Deposits fall to the bottom of the tank. Potency of the solution is not affected. Neither heating nor mixing are required.

Details are available from the company's Dept. M-298, 2939 Columbia Ave., Indianapolis 7, Ind. **T-7-1582**

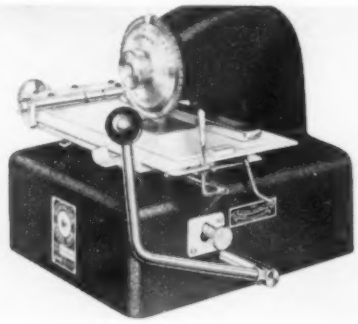
Multiple-Protection Motors

The Louis Allis Co., Milwaukee, Wis., has designed a line of electric explosion-proof motors that simplifies motor stocking. Any motor in the line may be used in all four hazardous locations designated as Class I, Group D, and Class II, Groups E, F and G with Underwriters' approval.

Multiple-protection motors are available in ratings of 1 to 25 hp, three-phase, and 1 to 3 hp, single-phase. Modifications of the three-phase motors are also available with Underwriters' approval for use in Class I, Group C, hazardous locations. **T-7-1583**

Metal Marker

Speed and accuracy in marking metal tags and nameplates are qualities of the Automark metal marking detail press introduced by Defiance Machine & Tool Co., 1959 S. Vandeventer St., St. Louis, Mo. Special feature of the press is the self-aligning table containing line and



tab spacing similar to standard typewriters. Operating time is reduced because no visual alignment is necessary.

Production speeds of approximately 40 characters a minute are possible. The press accommodates wheels of 39 characters from 1/16 to 1/4 in. in height. Character wheels can be changed in less than a minute. The dial is designed for quick reading. **T-7-1584**

Portable Grinding Wheel

The Blue Flash "BF" raised hub disk wheel, latest portable grinding wheel developed by Bay City Abrasive Products Co., Westboro, Mass., is designed to substantially increase cutting speed.

Construction changes, designed to take maximum advantage of the cutting ability of each abrasive grain, permit them to penetrate deeper and take bigger cuts of metal. In action,

the wheel removes metal faster with less work pressure.

This sharpness also exists on the entire underside of the wheel, permitting easy grinding and blending of external corner welds and convex surfaces.

Strongly reinforced internally and on the back the wheel is designed to accommodate weld grinding and portable cutoff applications found in metal fabricating plants and foundries.

Blue Flash "BF" wheel specification A-24R-BF, is available in 7 and 9-inch diameters and thicknesses of 1/8, 3/16 and 1/4 inch. **T-7-1591**

Variable Speed Pulley

Ratios up to 3 to 1 at from 7½ to 15 hp are provided by the variable speed pulley developed by Lovejoy Flexible Coupling Co., 4998 W. Lake St., Chicago 44, Ill. The pulley is easily and quickly installed on new or old equipment. Speed changes can be made while machinery is in full operation.

Used in conjunction with 1750-rpm motor, maximum hp is 10 with the #310 VSP base and 15 with the #315 VSP base. A 1150-rpm motor affords 7½ hp with the #310 and 10 hp with the #315. Belt accommodated is Lovejoy No. 27 2¾-inch top width variable speed belt. Standard bores are 1¼, 1⅜, 1⅝. Other specifications include 13.1 max. and 4.35 min. pitch diameter, length of bore 3¾ inches and max. bore 1⅝ inches. **T-7-1592**

Contour Projector

A contour projector which requires no special contour charts has been designed in Sweden especially for laboratory work and is available from Nife Inc., Copiague, Long Island, N. Y. Sharp, distortion-free images are projected directly to a ½-inch thick heat resistant glass screen for observation, inspection and measurement. Enlarged drawings can be made by the draftsman working directly on the glass screen without having to compensate for distortion. Direct readings are taken with an enlarged drawing, glass scale or table micrometer. Accuracy of the projector at 100X is 0.00004 to 0.0001 inch.

A wide variety of accessories, as well as a special built-in angle measuring vernier, focusing hand wheels and 3-way control panels, are available. A surface illumination unit permits study of blind holes, surfaces, etc. **T-7-1593**

Torque-Coupling

Techniflex Corp., Port Jervis, N. Y., has designed a torque limiting coupling. Up to the limit to which it is adjusted, the torque coupling acts as a conventional flexible coupling. Beyond this adjusted limit, the coupling permits a free wheeling or slip between the driving and driven halves of the coupling.

As a result of this slip, the coupling may be used in tripping a safety or emergency switch. In addition, it pro-

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-159

vides the ability to apply the repetitive detent action on which the slip effect is based towards a repetitive hammer-blow effect. A third property of the development is its ability to work as a bidirectional torque coupling with independent torque rating for each direction if required.

Couplings are available in standard nominal rating from 24 in-lb to 100,000 in-lb. All couplings are readily adjustable from 50 to 150 percent of their nominal ratings. **T-7-1601**

Electrode for Cast Iron

An electrode, especially recommended for the repair welding of cast iron has been placed on the market by Pacific Welding Alloys Mfg. Co., 310 N. Avenue 21, Los Angeles, Calif. The weld itself is easily machinable under all conditions of deposition.

The electrode, called Pacific Nickel Cast, can be operated from a-c or d-c; reverse polarity is recommended. At all times the welding current should be as low as possible.

Pacific Nickel Cast is easily applied, smooth flowing, with good bead contour. **T-7-1602**

Miller and Jig Borer

Linochine Products Corp., 145 42nd St., Brooklyn, N.Y., is manufacturing a vertical miller and jig borer with improved features for high production or prototype work. Model MC-1

is designed for increased efficiency ease of operation and maintenance, and greater rigidity, flexibility and accuracy.

Construction and design features are aimed at giving chatter-free vibration-less operation even when making heavy cuts with carbide tools. Twelve spindle speeds range from 80 to 3450 rpm. Accuracy of movement and plane are guaranteed within 0.00025 in. The unit is suitable for jib boring, drilling, vertical milling and fly cutting.

T-7-1603

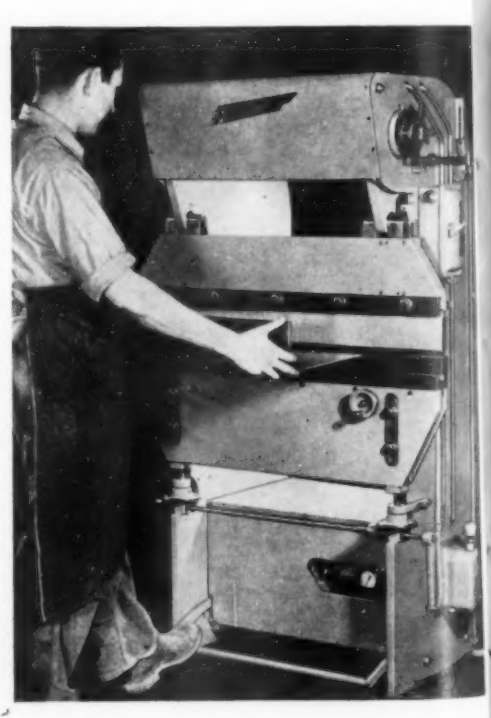
USE READER SERVICE CARD ON PAGE 165 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

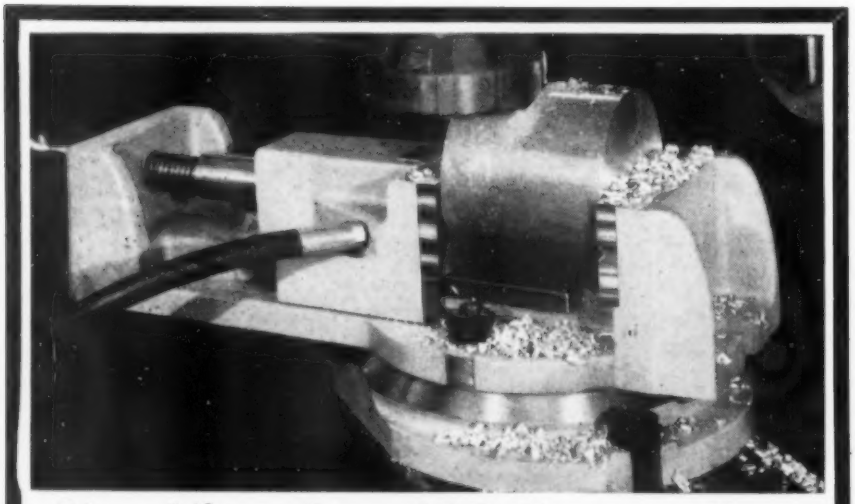
Hydraulic Press Brake

An hydraulically operated press brake that develops 12 tons of pressure and with a 36-in. length of bed and ram has been announced by O'Neill-Irwin Mfg. Co., 625 Eighth Ave., Lake City, Minn.

Special feature of Di-Acro Hydra-Power press brake is its stroke control selector which permits the most practical length of stroke for a given job to be preset without having to readjust the bed or die settings. The ram can be stopped or reversed at any point in a work operation. A bending cycle is completed during the forward movement of the hydraulic cylinder and another cycle is completed during its return.

Safety and speed are provided in punching operations because the press





Bites Like a Bear 800 Times an Hour

The MilOmatic "M M" Power Vise cuts loading time 80% and has a locking force of 9000 lbs. at normal air line pressure. This fast, strong, air powered hydraulic clamping means more production, less labor per piece on milling, drilling, grinding, shaping, broaching, and other machine applications. "M M" eliminates expensive tooling when specially shaped jaws are installed.

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TE-7

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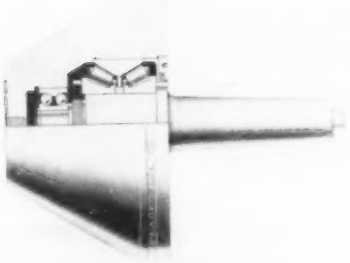
pening need only be adjusted for ightly more than the thickness of the aterial. A production rate of 60 okes per minute is possible on a -in. stroke. At the full 1½-in. open-ng, a rate of 24 strokes per minute n be maintained.

Standard equipment includes a back age which is adjustable both vertically nd horizontally. A micrometer type ront operated back gage is available s an accessory. **T-7-1611**

Bull Nose Center

An extra-heavy-duty bull nose center for lathes, engineered to perform accurately under the heaviest radial and thrust loads, has been developed by the Ready Tool Co., 554 Iranistan Ave., Bridgeport 5, Conn. Design of the center provides load capacities equal to the combined radial and thrust ratings



of the bearing assemblies. Model No. HD-200 is a 4 Morse taper, 1½ or 1¾-inch straight shank, has a 4-inch diameter head and 1½-inch nose. Model No. HD-300 has a 4 Morse taper, 1½ or 1¾-inch straight shank with a 5-inch diameter head and a 2-inch nose. The HD-400, 4 Morse has a 6-inch head and a 3-inch nose. Also available from stock in 8, 10, 12-inch head diameters, up to 7 Morse, 3 or 3½-inch straight shanks. Special heads, tapers, and straight shanks can be made to order. **T-7-1612**

Pipe Machine Chuck

A wrenchless power-grip type ⅛ to 2-inch pipe machine chuck, marketed by Beaver Pipe Tools Inc., Warren, Ohio, is so designed that it cannot lock, slip, or crush pipe or tubing, and will not mar soft material.

The chuck is free running. Forward or reverse is accomplished with equal ease, speed and gripping power. Only finger-tip pressure sizes the chuck for immediate use. Roller grip jaws are simple to insert without dismantling the chuck, and replacement parts also are quickly and easily installed. **T-7-1613**

Turret Punch Press

Wiedemann Machine Co. has developed the RA-4P turret punch press for piercing printed wiring boards at high speed in low to medium quantities (10 to 10,000 of a kind). The press offers low-cost tooling, flexibility and minimum setup. Engineering changes can be made quickly and inexpensively.

Holes of any size up to 1½ in. diam are punched to tolerances of ± 0.005 in. at the nominal rate of 80 to 120 holes per minute in printed wiring boards, terminal strips or small metal components. Holes are located with a color coded template.

Additional information is available from the company, 4272 Wissahickon Ave., Dept. 74, Philadelphia 32, Pa. **T-7-1614**

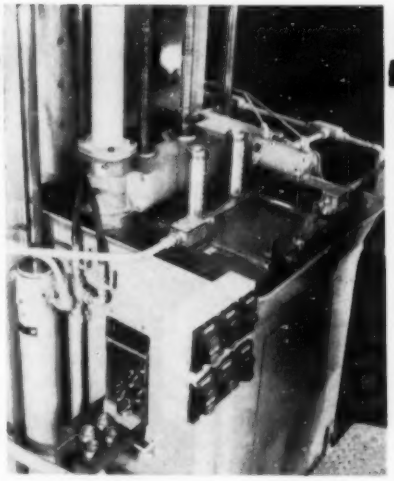
Metal-Cutting Band Saw

W. F. Wells & Sons, Three Rivers, Mich., has announced a 6 x 11-in. capacity metal-cutting band saw, Model "A" that incorporates many features common to larger machines.

Of sturdy construction throughout, the saw features precision saw guides, adjustable cutting pressure, adjustable rate of descent for cutting tubing and for light work, quick-action swivel vise, and a rotary blade brush. Blade of the saw is offset from the guide beam—½-in. blade keeps blade replacement cost at a minimum. Other features include an automatic blade shut-off, and overload protection for ⅛ hp motor. With addition of a table, this saw can be used in a vertical position for contour sawing, notching and slotting. **T-7-1615**

I. D. and four inverted helical splines **BROACHED** *the American way*

. . . 300 parts per hour



American engineering made this broaching operation fast, automatic and economical.

The finished inside diameter and four inverted helical splines are broached, in this automotive synchronizer ring, two at a time . . . 300 per hour.

American special combination round and spiral spline broaches are used to cut the splines concentric with the I.D.

Feed tubes are here shown as manually loaded but are readily adapted to automation. Parts are fed and ejected by automatic hydraulic slides.

You may have parts that can be produced at significantly lower cost by broaching them the American way. Send part print or sample . . . American engineers will make a recommendation you'll find valuable.

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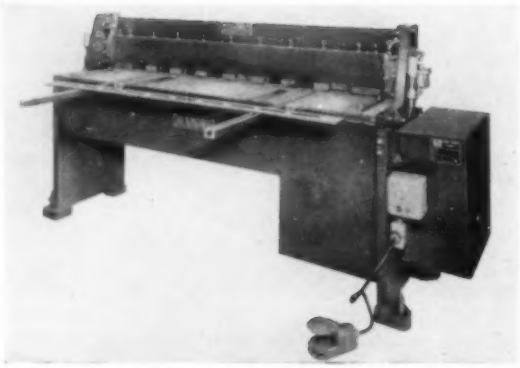
Power Squaring Shears

The Diamond Machine Tool Co., Pico, Calif. has offered a redesigned power squaring shear that is engineered to stall rather than break on overload. Features of this all-steel underdriven squaring shear include silent herringbone gearing, electric clutch, centralized lubrication, triangulated ram, and box type bed. Specifications of the unit include: 10-gage steel or stainless capacity; cutting length of 73 inches; shearing speed is 80 strokes per minute; required air pressure is 60-200 lb. Motor requirements are 5 hp, 1800 rpm. The shear's net weight is 4800 lb.



T-7-1621

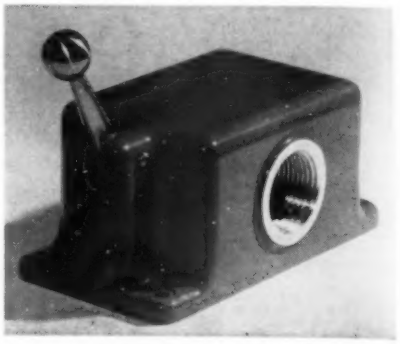
Vacuum Valve

A compact, lightweight vacuum va with unusually large flow capacity made by Bent & Davis Machine C 7213 Santa Monica Blvd., Los Ange 46, Calif.

Because it contains no sliding or ro tating seals, it cannot develop leaka after continued use. No springs are contained in the valve; the seal being maintained by the vacuum in both po sitions. Higher vacuum increases effec tiveness of the seal. Seats of the valve are self-cleaning and require little at tention.

The valves are available in various sizes and porting arrangements.

T-7-1622



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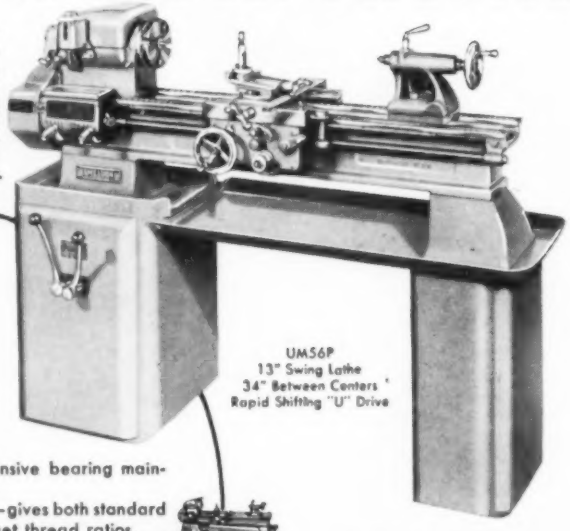

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34" Between Centers
Rapid Shifting "U" Drive

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- **54-pitch Gear Box**—gives both standard and many hard to get thread ratios.
- **Large Micrometer Dials**—Make accurate operation easier.
- **Extra Collet Capacity**—1⅜" hole through spindles available on 10", 11" and 13" swing lathes.
- **More Power to Spindle**—Efficient drives with bigger motors and double neoprene cog V-belts to spindle.

OPTIONAL FEATURES AT EXTRA COST
include: Hardened ways, Long Tapered Key Drive Spindles, 4" D1 Camlock Spindles bed turrets, collet attachments, and other production and toolroom accessories. Lathes available with a choice of "Bench," "Cabinet" or "Pedestal" mountings.

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See SHELDON BOOTH 702 - COLISEUM MACHINERY SHOW - CHICAGO - Sept. 6-17

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Jig-Fixture Clamping

An inexpensive air-actuated machine dog, developed by the Kajon Mfg. Co. of El Segundo, Calif., is made available through National Sales Agents, Burklyn Co., 3429 Glendale Blvd., Los Angeles, Calif. As work holder devices, both horizontal and vertical types, the new clamps, called Airmatic

clamps, cut change time move than 50 percent, reducing operator fatigue and avoiding dropping of fixtures.

They work on the usual 75 to 100-psi line pressure through any outlet valve. At 100 psi, the clamps exert a hold-point force of 600 lb. Setting the clamps consists simply of tightening in desired position with standard ½-in. bolts. Designed to be used with simple pin fixtures to keep work from swiveling, they also work equally well with blocks.

T-7-1623

Slot Grinder Attachment

Enclosed contours, including sharp corners, key slots and other forms, can be ground on the No. 2 Moore jig grinder with the substitution of a horizontal-spindle slot grinder attachment for the vertical-spindle grinding head. The attachment is available as an accessory from Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.

Although the horizontal spindle axis is nominally normal to the travel of the

outfeed slide, its rotatable mounting permits any other desired angular relationship.

A slide provides for axial adjustment of the wheel position, so that it can be set radial to, or offset from, the main spindle axis. This adjustment is necessary in centralizing angles dressed on the wheel face, and for dressing a wheel to grind a slot central in the bore of a hole.

The attachment is motor and V-belt driven and takes unmounted wheels from 7/8 to 1½-inch diameter. Spindle speeds are approximately 18,000 to 22,000 rpm. **T-7-1631**

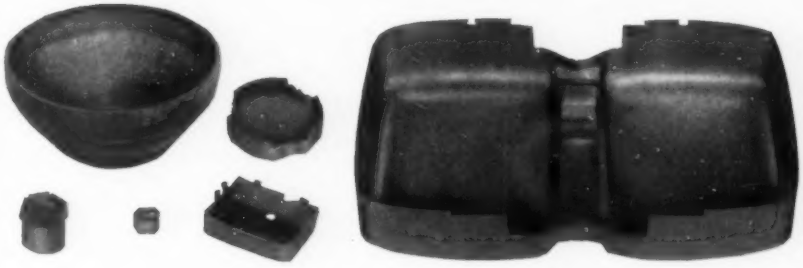
USE READER SERVICE CARD ON PAGE 165 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Indexing Unit

Troyke Mfg. Co., 4422 Appleton St., Cincinnati 9, Ohio, has patented a Roto-Indexer for rapid, positive, accurate indexing in connection with milling, drilling, jig boring, grinding and slotting. It may be used in either vertical or horizontal position.

Special feature of the unit is the block-out arrangement—a hardened and ground twenty-station index plate of which any or all stations can be blocked out with use of screwdriver only. The

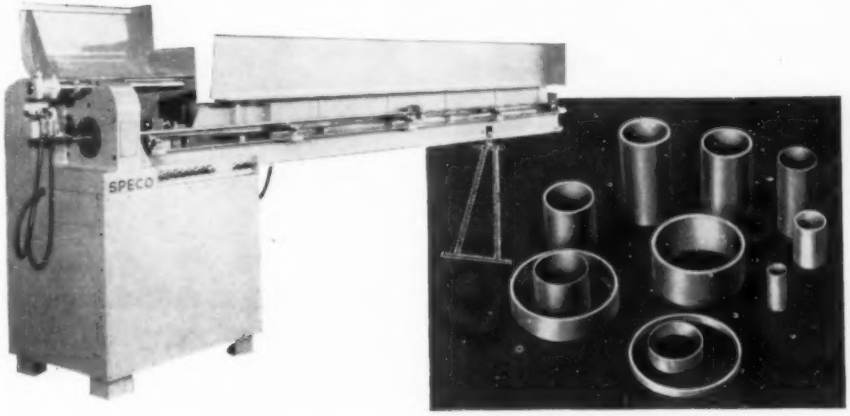
You can trim drawn shells like these in a single press stroke!



The Brehm "Shimmy" Die employs a *radically new* trimming principle . . . completely different from ordinary trimming methods. *A cam action inside the die moves the shearing edges four ways*—eliminating slow, costly "horn" and "pinch" trimming operations. You get a perfect edge finish every time . . . and a single die may be used for many different shapes. Production goes up fast. Production costs are slashed! Trims stainless and mild steel, copper, brass, zinc, aluminum, gold, silver, fiber, rubber, plastics. Trims all sizes from fountain pen ferrules to refrigerator doors—in almost any thickness that can be drawn. Brehm Dies can be used in mechanical or hydraulic presses.

The NEW Brehm Trimming Press does *all* trimming in one press stroke . . . takes less power, trims shells up to 16 inches square, 6 inches deep, .125 inch stock—metals, plastics or fibers.

Up to 10,000 pieces in 86 minutes with the new Brehm tube cutter!



The revolutionary Brehm Tube Cutter has a cutting action that makes it the finest machine of its kind ever built! Cuts tubes 3/8" to 2¼" O.D.—with production speeds ranging up to almost 7,000 pieces per hour! With the Brehm shearing action, *there is no loss of stock*—no burred tube ends! Up to 25% more pieces from the same length of stock. Cuts almost any tubing—mild steel, stainless steel, brass, copper, aluminum, etc.

Brehm

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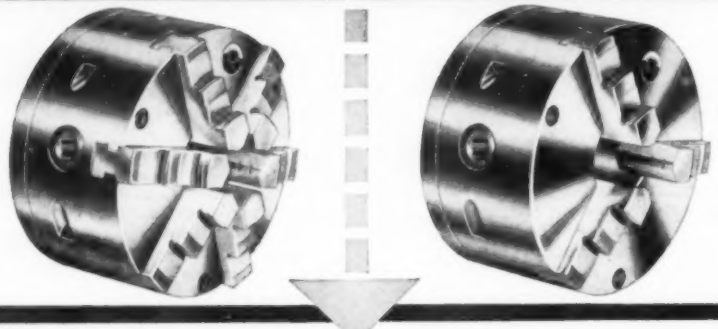

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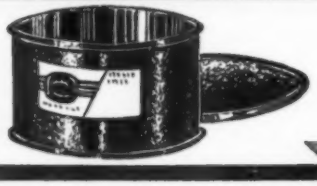

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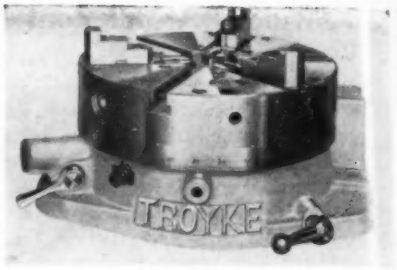


locking center bearing is adjustable for wear.

The indexer is made in 2 sizes (12 and 15 inches) available in four models: AC-12 has special 12-inch diameter steel body chuck; AX-2 has 12-inch platen with a 4½-inch diameter pilot; AH-12 has 12-inch T-slotted turntable; and AL-15 has 15-inch T-slotted turntable.

Two models of drilling attachments are also available. **T-7-1641**

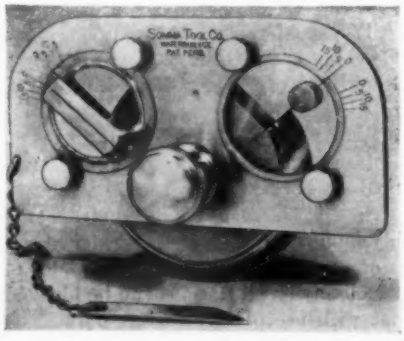
Electrical Connectors and Tools

Tools for making fast, permanent splices on conductors from #4 through 500 MCM have been designed by F. M. Anthony Co., 2022 Oakland Ave., Piedmont 11, Calif. Insul-Lock connectors, terminal lugs, cable tips or tees are slipped over a wire end, and a full circumferential crimp is applied with the hand-operated crimping tool without heat or die change. The tool has an easy ratchet action; it may be used in cramped spaces. Connections are made in seconds, with assured maximum current capacity and mechanical strength. **T-7-1642**

Cutting Edge Gage

The Somma Tool Co., 15 Brown St., Waterbury, Conn., has introduced a high-precision gage, called the Scribe-Chek cutting edge gage, for checking and sharpening circular form tools used on automatic screw machines.

It permits scribing of the exact cutting edge required on the tool (with or without top rake) and visual checking of the results after sharpening. If



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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Literature Number	COMPANY	DESCRIPTION
A-7-149	Acme Industrial Co.	**Drill Bushings**—Catalog contains price list and bushing information for tool engineers, designers, plant executives and purchasing agents. (Page 149)
A-7-216	Allegheny Ludlum Steel Corp.	**Cutting Tool Materials**—Thirty-six-page illustrated booklet analyzes and compares types and covers grade selection for major classes of cutting tools, etc. (Page 216)
A-7-161	American Broach & Machine Co.	**Broaching Machines**—A complete broaching manual is contained in the American catalog 450. (Page 161)
A-7-13	American Drill Bushing Co.	**Drill Bushings**—New catalogs describe American bushings and feature 3-D simplified ordering methods. (Page 13)
A-7-34	American MonoRail Co.	**Hoists**—How MonoRails can be applied to the various lifting jobs is explained in bulletin C-1. (Page 34)
A-7-10	The American Tool Works Co.	**Radial Drills**—A complete revelation of the virtues of American Hole Wizard Radial drills, as contained in bulletin 327. (Page 10)
A-7-178	B. C. Ames Co.	**Dial Indicators**—Ames catalog contains complete descriptions of dial indicators. (Page 178)
A-7-196-1	Anocut Engineering Co.	**Electrolytic Shapers**—Anocut machines and their operation in grinding and shaping carbides, alloy steels, etc. is contained in new manual. (Page 196)
A-7-207	Bay State Abrasive Products Co.	**Centerless Grinding Wheels**—Bulletin 201 describes the features of Bay State centerless grinding wheels. (Pages 206-207)
A-7-252-2	Black Diamond Saw & Machine Works.	**Drill Grinders**—All facts concerning drill grinders are contained in 4-page illustrated bulletin. (Page 252)
A-7-227	Brush Electronics Co.	**Surface Finish Indicators**—Booklet describes ASA Standard B46.1 and illustrates the Surfindicator. (Page 227)
A-7-27	The Cincinnati Shaper Co.	**Shapers**—Catalog N-6 discusses the new Electro-Magnetic clutch and brake and other features of the Cincinnati shaper. (Pages 26-27)
A-7-226	The Cleveland Crane & Engineering Co.	**Shears**—Catalog 2011 is illustrated and gives construction and engineering details. (Page 226)
A-7-198	Consolidated Engineering Corp.	**Vibration Meters**—"Machine Tools and Vibration," Bulletin CEC 1555-X1, explains how to locate and measure vibrations. (Page 198)
A-7-36	Crucible Steel Co. of America	**High-Speed Steels**—Rex and other types of Crucible special purpose steels are described in Crucible catalog. (Page 36)
A-7-210-2	Detroit Stamping Co.	**Portable Clamps**—De-Sta-Co bulletin 482-4-6 describes the types and construction features of Trigger-Release clamps. (Page 210)
A-7-11	Eastman Kodak Co.	**Contour Projectors**—"Kodak Contour Projectors" describes the advantages of inspecting with projectors. (Page 11)
A-7-194	The Engelberg Huller Co., Inc.	**Abrasive Belt Grinders**—Booklet shows how belt grinding performs grinding, surfacing, stock removal and other operations economically and fast. (Page 194)
A-7-190	Erickson Tool Company	**Indexers**—Catalog K discusses applications for all Erickson holding tools. (Page 190)
A-7-157	The Gaertner Scientific Corp.	**Toolmakers' Microscope**—Bulletin 147-50 describes the operation and advantages of optical microscopes. (Page 157)
A-7-228	Giddings & Lewis Machine Tool Co. Davis Boring Tool Div. of	**Block Tools**—Information concerning block tools for boring and facing operation is contained in catalog 304. (Page 228)
A-7-33	Greenfield Tap and Die Corp.	**Taps**—"Facts about Taps and Tapping" discusses Greenfield taps. (Page 33)
A-7-185	The Hartford Special Machinery Co. Machine Tool Division	**Drill Units**—New catalog discusses operating features and construction quality of Hartford drill units. (Page 185)
A-7-155-1	Hydro-Line Mfg. Co.	**Cylinders**—Bulletin 53 reveals the construction features and specifications of Hydro-Line's Series J cylinders. (Page 155)
A-7-37	Ideal Industries, Inc.	**Live Centers**—Catalog presents a complete discussion of Ideal live centers. (Page 37)

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Literature Number	COMPANY	DESCRIPTION
A-7-241	Jarvis Corp.	**Cuttings Tools**—Four catalogs are available which discuss Jarvis tools such as end mills, carbide reamers, boring tools, etc. (Page 241)
A-7-14	Keller Tool Div. Gardner-Denver	**Nut Setters**—How Keller nut setters increase production economically is discussed in bulletin 16-101. (Page 14)
A-7-156	Kling Bros. Engineering Works	**Metal Fabricating Machines**—Bulletin 100 illustrates and gives data for over 50 machines. (Page 156)
A-7-189	Lehigh, Inc.	**Air Motors**—Double Acting air motors and how they operate are discussed in descriptive catalog. (Page 189)
A-7-151	The Lincoln Electric Co.	**Welding Machines**—The whole story for Idealarc type welders is discussed in bulletin 1343. (Page 151)
A-7-148	Linde Air Products Co. Div. Union Carbide and Carbon Corp.	**Carbide Plating**—Advantages of and applications for flame plating process is described in booklet. (Page 148)
A-7-196-2	F. J. Littell Machine Co.	**Coil Reels**—Advantages of double automatic centering reels are discussed in catalog. (Page 196)
A-7-248-4	Lovejoy Tool Co., Inc.	**Cutting Tools**—Three catalogs are available on arbors, face mills and side mills; also speed and feed calculator. (Page 248)
A-7-248-1	McDonough Mfg. Co.	**Tool and Cutter Grinders**—Sterling Model RK-2 grinder discusses the construction and economies possible with illustrated bulletin RK-2. (Page 248)
A-7-22	Metal Carbides Corp.	**Rolling Mill Rolls**—Eighty-four-page catalog 55-G discusses the advantages of Talide work rolls. (Page 22)
A-7-251	Miller Fluid Power Co.	**Hydraulic Cylinders**—Bulletins H-104 and A-105 describe the complete line of Miller cylinders and discuss their advantages. (Page 251)
A-7-64	National Broach and Machine Co.	**Broaching Machines**—Red Ring bench-type broaching units are described in bulletin B54-9. (Page 64)
A-7-202	Nelco Tool Co., Inc.	**Milling Cutters**—Forty-eight-page comprehensive catalog discusses the variety and advantages of Nelco tools. (Page 202)
A-7-31	Niagara Machine & Tool Works	**Gap Frame Presses**—Details on all Niagara features are given in bulletin 65. (Pages 30-31)
A-7-54	Nice Ball Bearing Co.	**Ball Bearings**—Catalog 150 discusses construction features and advantages of the Nice bearings. (Page 54)
A-7-213	Ortman-Miller Machine Co.	**Air and Hydraulic Cylinders**—Catalog contains information concerning O-M cylinders and one-half scale templates showing all cylinders, mounts and mounting brackets. (Page 213)
A-7-171	Seibert & Son, Inc.	**Tap Drivers**—Folio 2-50 illustrates and describes the complete line of Seibert adapters and tap drivers. (Page 171)
A-7-162	Sheldon Machine Co., Inc.	**Lathes**—New catalog G-55 discusses the design and optional features of Sheldon lathes. (Page 162)
A-7-170-2	Standard Parts Co.	**Jig and Fixture Components**—Economies and other advantages of Standard's components are discussed in 66-page catalog. (Page 170)
A-7-244-2	P. A. Sturtevant Co.	**Torque Wrenches**—Data concerning torque wrenches are contained in catalog. (Page 244)
A-7-49	Sundstrand Machine Tool Co.	**Lathes**—Complete line of Sundstrand automatic lathes is included in new 32-page booklet. (Pages 48-49)
A-7-236	U. S. Tool Co., Inc.	**Special Machines**—Bulletin 15-T contains specifications for U.S. Multi-slide machine. (Page 236)
A-7-58	The Van Keuren Co.	**Carbide Plug Gages**—Two hundred-twenty-page catalog and handbook 35 contain technical and engineering information on measuring problems and methods. (Page 58)
A-7-169	Waldes Kohinoor, Inc.	**Grooving Tools**—Twenty-page manual contains full information on Waldes Tru-Arc grooving tool. (Page 169)
A-7-142	S. B. Whistler & Sons, Inc.	**Magnetic Perforating Dies**—Catalog describes Whistler magnetic dies and illustrates speed and simplicity of setup. (Page 142)

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particular cutting angle has been established already, it can be measured and consistently reproduced thereafter. The gage may be used by an inexperienced worker.

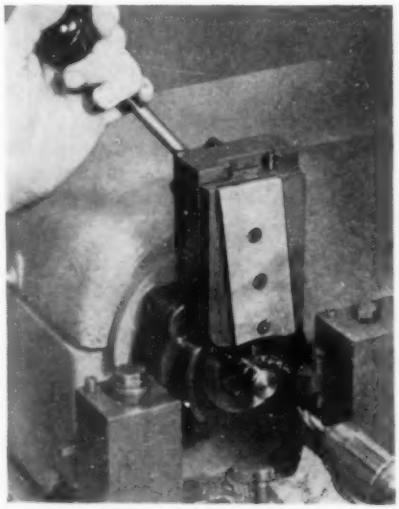
Two dials are set into a plate. One of these dials, for checking, has a lens with a hairline which, when lined up with graduations on the plate, indicates either left or right-hand cut at any rake between 0 and 15 deg.

The other dial, for marking form tools for grinding, is a slotted ring and its slots line up with graduations on the plate for any rake, 0 through 15 deg, left or right. **T-7-1671**

Vertical Lathe Tools

Vertical lathe tools for fast and precise production cutoff and form work are available from Lathe Tool Div., Wesco Machine Corp., 7536 San Fernando Rd., Sun Valley, Calif.

Manufactured in two models, the cutoff tool features an automatic return type slide which holds a standard cutoff blade. The vertical form tool also incorporates an automatic return type of slide which holds a standard ½-in. tool bit. Adjustable stops are provided. Both Wesco units mount on headstock of lathe for maximum rigidity. These tools are easily installed and can be quickly set up for operation. The positioning of the cutoff blade assures close working to collet for rigid, fast cutting. By providing a third position for turret lathes, use of the Wesco tools often deletes necessity of the usual second operation.

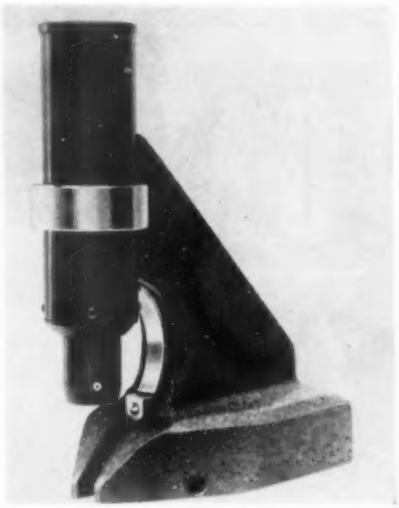


The vertical lathe tools are designed for use on Elgin, Hardinge, Delta, Atlas, Logan (10, 11 and 12-in.) Warner Swasey (#1 and #2), Clausing, Craftsman, South Bend and Sheldon lathes. **T-7-1672**

Layout Tool

Moran Instrument Corp., 170 E. Orange Grove Ave., Pasadena 3, Calif., offers a Micro-Punch instrument for layout work that will mark any flat surface for precision drilling. Specifically, it is useful for prick-punching the intersections of scribed height gage lines and for marking photo-etched templates as used in printed circuitry.

The Micro-Punch combines a high-quality microscope with a precision



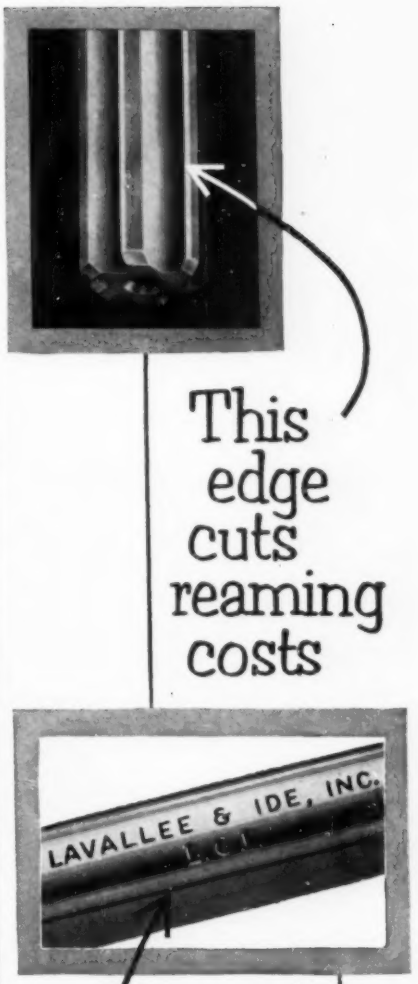
automatic center punch. The center punch is operated by a balanced trigger mechanism that releases a spring action hammer which does the marking. With it, ordinary skilled layout men can maintain an accuracy of better than 0.001 inch.

The instrument operates with no jarring or recoil when the hammer is released. The microscope is fully adjustable to individual visual differences. The indenter point is hardened and ground and can be easily removed for regrinding or replacing. A simple collimation adjustment has been provided so that any mechanic can quickly readjust the instrument. **T-7-1673**

Cutting Compound

A safe and economical cutting solution for all types of machine tools may be made by dissolving in water a synthetic cutting compound called Dromus Oil E perfected by Shell Oil Co., 50 W. 50th St., New York 20, N. Y. The resultant fluid, not an emulsion, differs from conventional petroleum-base cutting fluids, in that it has exceptional cooling properties and permits higher speeds and feeds. The solution is stable at all temperatures normally encountered.

The new product may be mixed with a large volume of water to utilize the



latter's very high cooling effect. It prevents rusting of parts or equipment while improving the solution's wetting characteristics to reduce friction between tool and chip.

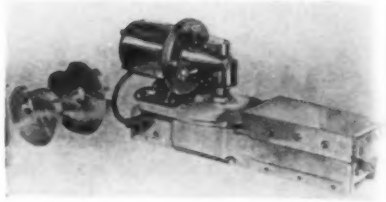
A properly prepared solution will not froth or foam objectionably, or form hard-to-clean sludge, and leaves no oily or greasy deposits. Chips and grit settle out rapidly and thus are not recirculated. If the machine is to be cleaned or dismantled, the clear coolant may be syphoned off the top and reused. **T-7-1681**

Power Feed Unit

Cam-controlled automatic feed cycles for precision metalworking operations are provided by the cycling power feed unit, announced by Russell T. Gilman, Inc., 1243 Milton Ave., Janesville, Wis.

This self-contained mechanical unit consists of a slide assembly, feed mechanism, cam drive motor and housing. Any desired tooling setup may be mounted on the slide.

An infinite variation in feed cycles is possible simply by changing cams,



which can be done in two or three minutes.

The compact cycling power feed unit measures 17 inches long, 6 inches wide and 8⅛ inches high to the top of the motor housing. It can be mounted in a horizontal or vertical plane, or at any angle.

The slide assembly has a working surface of 4 x 6 inches and provides a maximum stroke of 2 inches. A gearmotor rotates the cam which regulates the feed cycle of the slide, delivering a torque of 52 in.-lb. Standard cycle times of 4, 6, 8, 10, 12 and 16 seconds per revolution are available. **T-7-1682**

Liquid Heat Treat

Steel production parts and tools may be heat treated by a liquid substance that is either painted on or used as a dip to obtain a hardness as high as 60 R_c. In a few minutes at the treating temperature, the hardness reaches a depth of 0.003 to 0.010 inch while in 30 to 45 minutes depths of 0.015 to 0.020 can be obtained.

This hardness and depth is obtained through use of liquid Armor-Tuf available from Armor-Tuf Sales Corp., 299 Madison Ave., New York 17, N. Y. When coating is dry, pieces are placed in the furnace and brought up to 1400 to 1600 F to obtain the heat-treated hardened results. **T-7-1683**

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Air Press

Vi-Speed air presses, P66 series, are announced by Van Products Co., 5789 Old Ridge Rd., Swanville, Erie 7, Pa. These presses feature a 6 x 6-in. platen guided by a 5-in. piston rod and powered by a 5-in. cylinder with either 3 or 6-in. stroke. The massive ram provides a maximum of guiding surface for maintaining close tolerances on all pieces including those held off-center. These presses are used for die sets, punching, swaging, press fitting, light bending and forming, crimping, wire splicing and light forging. There are four standard models with a vertical,

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In Canada: A. C. Wickman (Canada) Ltd., Queensway, Toronto 14
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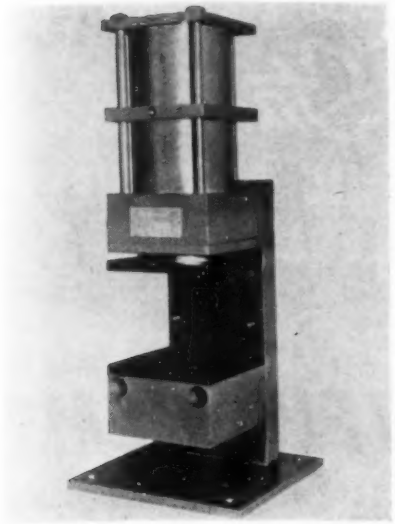


adjustable clearance of 8 in.

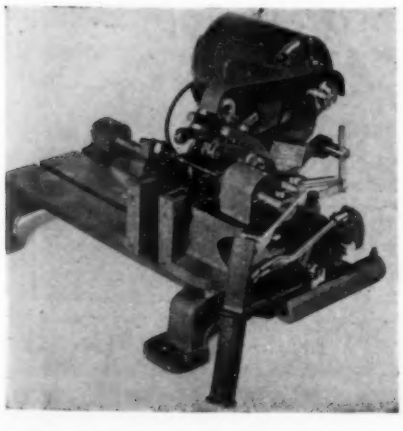
Units are available with either single or double power, providing 1900 or 3800 pounds thrust at 100 psig. Working pressures range from 15 to 150 psi. Models are available with an air return where heavy fixtures are to be attached to the moving platen.

By removing the base plates, they may be used horizontally as presses or vises for drilling, tapping and milling, etc., on a production basis.

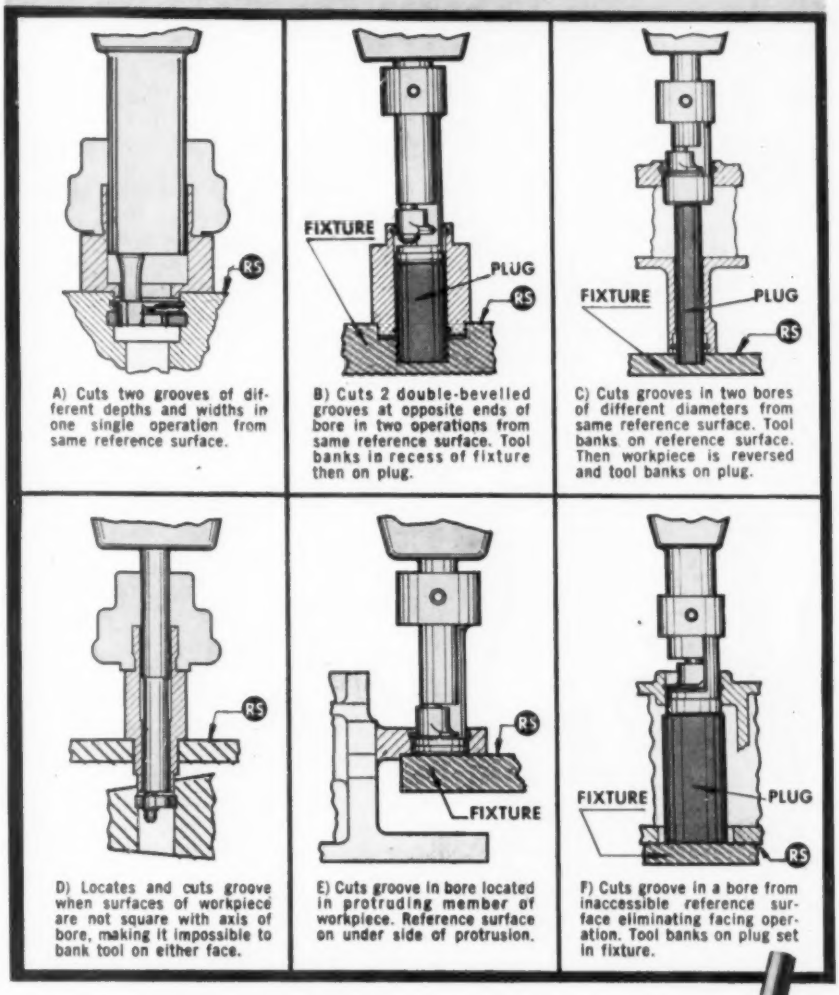
T-7-1691

Centering Unit

A strong, compact, bench-mounted centering machine that holds round workpiece concentricity to within 0.0003 inch, and maintains drill center depth tolerances of 0.002 inch, has been developed by the Central Engineering Co., 930 Erie St., Racine, Wis. This portable machine tool centers, drills, spot faces, chamfers and pinpoints round workpieces of any length up to 1 inch in diameter. There is no distortion of ends, flaring and tool breakage is minimized since workpiece is rotated up to speeds of 15,000 rpm while the tool



Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models... enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints... let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 28-page manual containing full information on Waldes Truarc Grooving Tool

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Waldes Truarc Grooving Tool Manufactured Under U. S. Pat. 2,411,426

TE077
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Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)
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remains stationary. External diameter of a workpiece may be finished before the ends are centered or drilled.

The tool is capable of producing centers at the rate of 800 per hour, and is easy and fast to set up. According to the manufacturer, inexperienced employees can perform every operation without error in a very short time.

T-7-1701

Riveter

Production of its G-400 automatic riveter has been announced by General Riveters Inc. Designed as an economical replacement for hand and bench riveting methods of small assemblies, the tool is inexpensive, easy to operate and adaptable to a full range of large and small aircraft fabrication.

By eliminating the human factor, quality is improved, further reducing costs. The G-400 may be used with all types of work positioners including those fully automatic tape-controlled.

T-7-1702

Automatic Gage and Sorter

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio, announces an automatic inspection unit for gaging and sorting parts into as many as five specific size categories plus oversize aud undersize, at speeds of more than 3000 parts per hour.

This Autosort Model 101 handles parts up to 3-in. length and ¾-in. OD, and can be arranged for checking

NOBLE & STANTON

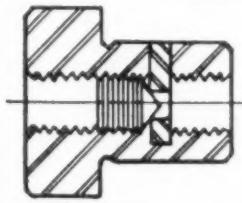
Standard

JIG & FIXTURE COMPONENTS

Just a Few of the Many

NEW ITEMS

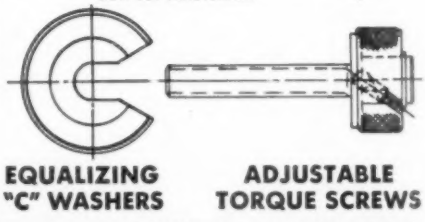
in our Line of 500 Components



SURE LOCK FIXTURE KEYS

DOUBLE CAM LEVERS

FLAT NOSE HEEL CLAMPS
Soft for Alteration



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length, thickness, OD or any other external measurement. Size ranges from 0.0002 to 0.010 in. can be furnished for sorting by increments as small as 0.000050 in.

Basic elements of the Autosort are the same for all applications. Mechanical parts such as the gage head support, anvil, feeding fingers and discharge chutes are furnished to individual requirements. The cabinet is modified as necessary to accommodate any desired means for loading the hopper and discharge of the work.

T-7-1711

Finishing Tool

On page 178 of the April issue of THE TOOL ENGINEER, the Di-Profiler finishing tool was incorrectly described as being made by Nord International Corp. Instead it is made by AB Dentatus of Stockholm, Sweden, and distributed by Nord. The foot control attachment described in the item is also distributed by Nord.

USE READER SERVICE CARD ON PAGE 165 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

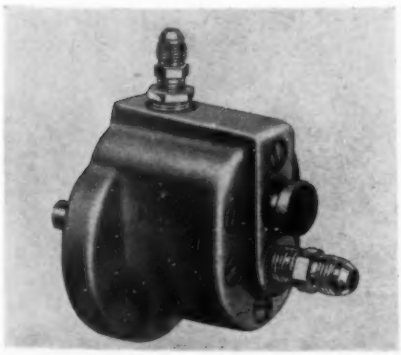
Variable Delivery Gear Pump

A variable delivery gear pump, Model FVI, has been introduced by Nathan Manufacturing Corp., 45-02 Ditmars Blvd., Long Island City 5, N. Y. Working principle of the pump permits adjustment to deliver lubricant at any rate from 3½ to 10½ gph. Adjustment may be automatically or by hand in stages of 1½ gph.

Rate of flow can be controlled while the pump is in operation and positive delivery is accomplished without throttling. Result is constant and uniform delivery even when lubricants of different grades are used. Very little heat is generated during operation.

Designed for a rotary drive, the Nathan Gear Pump is small and compact, measuring but 2⅝ x 3⅛ x 3½ in.

T-7-1712



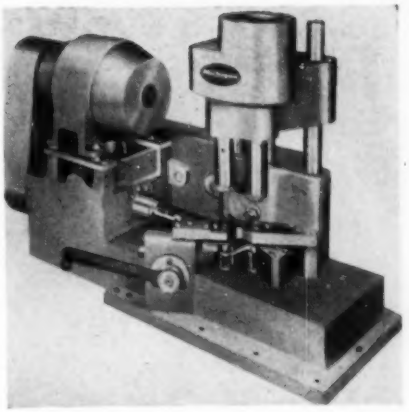
Two-Way Drilling Unit

A compact, economical unit, introduced by Michigan Drill Head Co., P. O. Box 4643, Detroit 34, Mich., permits right-angle drilling on any standard drill press. It utilizes only one feed source on the press.

The self-contained units are mounted or removed easily, permitting quick change to other tooling.

Operation is simple, yet accurate. Pressure from the vertical unit, while drilling, advances the horizontal unit. Feeding of the cross or right-angle is accomplished by rack and pinion gears. All moving parts are lubricated automatically from a built-in reservoir.

The unit illustrated is drilling 4 holes in a gear shift lever with only 3 spindles: 2 vertical holes, and 1 right-angle hole through the clamping arms.



Additional spindles for the unit can be provided for either vertical or horizontal drilling, enabling any number of operations to be performed on a standard drill press.

T-7-1713

New SEIBERT TAP DRIVERS

PERMIT FASTER AND EASIER TOOL CHANGES IN CLOSE-CENTERS

★ Seibert now offers a new, improved adjustable Tap Driver, available in both Tension or Compression types, that is easier to work with in close-center jobs and provides added strength and rigidity to the nose of the float. With the new Seibert one-piece holder, taps are now held securely and accurately in place by a trepan clamp. This design feature permits faster and easier change of taps and eliminates the hex nut method of holding which is difficult to work with in close-center work and which, on occasion, will twist off the nose of the float if turned too tight. Elimination of the hex nut also permits greater clearance for tapping in counterbored holes.

PRECISION-BUILT TO MAINTAIN CLOSE TOLERANCES

Like all Seibert Production Holding Tools, these new Tap Drivers are precision-built from highest quality alloy steel, hardened and ground for perfect fit. Diameters are held to .0003", and total concentricity 6" from the nose is held to within .002" (total indicator reading).

ADDITIONAL DATA

Write today for Folio 2-50 illustrating and describing the complete line of Seibert Adapters and Tap Drivers.

View of new trepan method of holding that is easier to work with and provides greater clearance in close-center jobs.

Shur-Lock Adapter Bodies

Shur-Lock Micro-Nuts

Spindle Extension Assemblies—800 Series

Spindle Extension Assemblies—900 Series

SEIBERT **SEIBERT & SON, INC.** CHENOA, ILLINOIS

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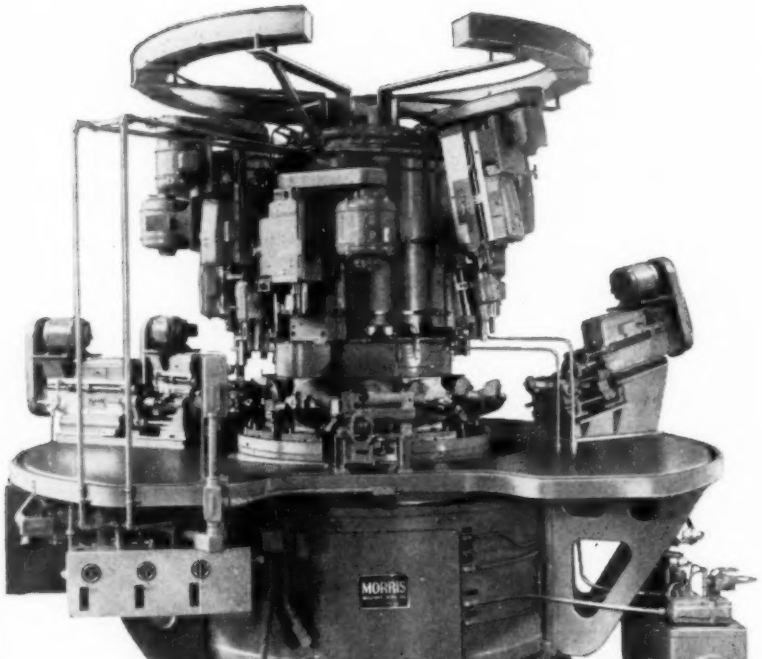
a production machine—with standard units—quick change-over features—for each year's design change. completely automatic—requires only part loading and unloading.



Morris Unit-Type Machine Tools provide specialized machining; use standard components; add flexibility to your high speed mass production operations.

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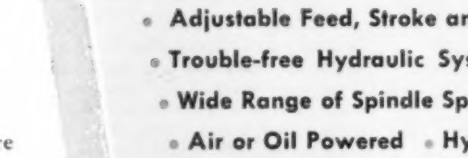

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Men at Work

Douglas H. Thomson has been elected president of The E. Horton & Son Co. to succeed **Robert S. Cooper** who recently resigned. Mr. Thomson, who has served the company as vice-president and secretary since 1948, also is a director of Forbes-Wallace and Consolidated Dry Goods Corp. He is a member of ASTE's Hartford chapter.

Tinius Olsen II was elected president of the Tinius Olsen Testing Machine Co. at the board of directors' annual meeting. He succeeds his father, **Thorsten Y. Olsen,** who was made chairman of the board.

At the same meeting, **C. Robert Tait** was made a vice-president and **Walter P. Haun,** former secretary, was named secretary-treasurer. Mr. Tait also continues in his capacity as works manager.

Officers elected at the annual meeting of the Metal Powder Assn. included **Morris Boorky,** president of Presmet Corp., as president, and **B. T. duPont,** Plastic Metals Div. of National-U.S. Radiator Corp., as chairman of the board. Vice-presidents elected for the association are **R. D. Ponemon** of Pyroferric Co. Inc., **E. H. Klein** of New Jersey Zinc Sales Co. and **D. L. Almquist** of Stackpole Carbon Co.

New officers elected by American Foundrymen's Society included **Bruce L. Simpson,** president of National Engineering Co., who was made president of the society for the current term, and **Frank W. Shipley,** of Caterpillar Tractor Co., who was elected vice-president.

Edward P. Gillane (left) is new president, general manager and member of the board of Potter & Johnston Co.

Wilfred J. Pender (right) was elected Potter & Johnston vice-president and factory manager.

Both Mr. Gillane and Mr. Pender belong to ASTE's Little Rhody chapter.

Announcement from Allis-Chalmers Mfg. Co. has named **William A. Yost, Jr.** to the recently created post of vice-president of staff operations. Previously, Mr. Yost was vice-president, general machinery division.

James F. Magin, vice-president and a director of the Square D Co., has been appointed general manager of the firm's Industrial Controller Div.

Appointment of **G. E. Jones** as vice-president and manager of its Proto Tools Div., has been made public by Plomb Tool Co. He now assumes manufacturing, distribution and other management responsibilities of **Claude Boring,** who recently resigned.

At the annual meeting of the American Zinc Institute's board of directors, **F. S. Mulock** was elected president of the organization for the coming year. Mr. Mulock is president of the U. S. Smelting, Refining & Mining Co. Three vice-presidents elected included **C. Merrill Chapin, Jr.** of St. Joseph Lead Co., **R. G. Kenly** of The New Jersey Zinc Sales Co., and **E. H. Snyder** of Combined Metals Reduction Co.

McClure Kelley was elected president of Baldwin-Lima-Hamilton Corp. He has been executive vice-president of the firm since he became associated with it in 1954.

Robert C. Overstreet is now president of Tinnerman Products, Inc. Associated with the company since 1941, he has been its executive vice-president.

Ralph W. Burk has been elected to the post of executive vice-president of Kearney & Trecker Corp. He has been vice-president in charge of sales and manufacturing.

Joseph V. Delaney has been named vice-president of Lodge & Shipley Co. He also continues as director of the company and general manager of the Hamilton Div.

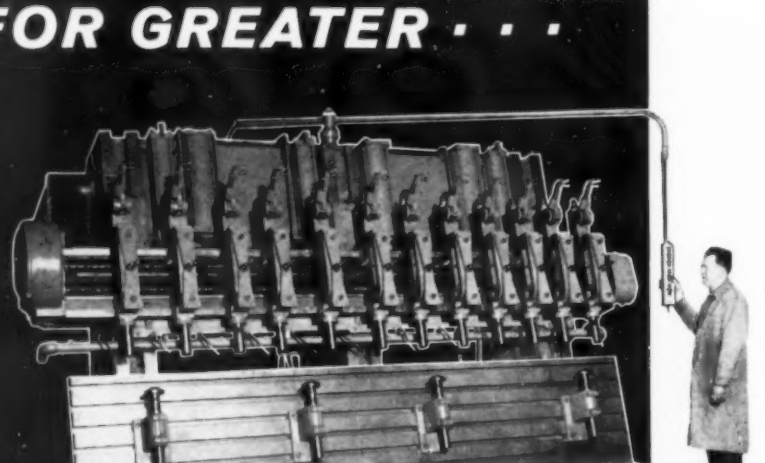
Charles B. Tansley has been elected president of Bryant Machinery & Engineering Co. while **Martin J. Wiora,** former president was elected to the newly created position of chairman of the board.

Promotion of **Eugene L. Mackey** to the post of director of engineering has been announced by The Yoder Co. Mr. Mackey, who has been with the firm for 20 years, was formerly chief engineer in charge of estimating.

C. H. Kimmel (left) is new president of the Ohio Crankshaft Co. He has been vice president and general manager of the company for the past two years.

M. J. Hoke (right) was made vice president and general manager of Ohio Crankshaft's crankshaft and camshaft division. He had been works manager.

FOR GREATER · · ·



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Following the retirement of **Arch A. Warner** as president and general manager of the Mechanics Universal Joint Div. of Borg-Warner Corp., **L. G. Porter** was elected by the division's supervisory board to serve temporarily as president. Mr. Porter, who will serve until a successor to Mr. Warner is appointed, is administrative vice-president of Borg-Warner Corp.

Frank W. Glaser has been made vice president and director of the Alloy Precision Casting Co. in charge of new development work, engineering and production operations.

Cyrus N. Johns, president of American Chain & Cable Co., Inc. has been elected the company's chief executive officer succeeding **Wilmot F. Wheeler.** Mr. Wheeler, who has held that position since 1946, will continue as chairman of the board.

Appointment of **Arthur R. Lytle** as vice-president in charge of research for Electro Metallurgical Co., a division of Union Carbide and Carbon Corp. has been revealed. Mr. Lytle has been associated with Union Carbide since 1923, and its director of research for Electro Metallurgical since 1952.

The Scientific Apparatus Makers Assn. has elected **Henry F. Dever** president for the coming term. Mr. Dever is president of Brown Instruments Div. of Minneapolis Honeywell Regulator Co.

Two executive appointments at Cleveland Instrument Co. included **David M. Gaskill** who became sales manager, and **Robert F. Baskin** who was made manufacturing manager in charge of engineering and production. Both men formerly were associated with Brush Electronics Co.

Trade Literature

For Free Booklets and Catalogs—Convenient Request Card on Page 165

Boring, Drilling, Milling

Catalog lists specification and construction details on 4-in. spindle diameter machines for horizontal boring, drilling and milling; section of brochure devoted to special attachments and controls; well illustrated. The Portage Machine Co., 1054 Sweitzer Ave., Akron 11, Ohio. **L-7-1**

Riveting

Latest revised edition of catalog presents up-to-date information on line of riveting tools and equipment as well as pertinent general engineering information; well illustrated by drawings; includes specification tables. The Hi-Shear Rivet Tool Co., 8924 Bellanca Ave., Los Angeles 45, Calif. **L-7-2**

Hobs

Informative booklet on fine pitch hobs, revised to include up-to-date information, covers recently announced American Standard 20-deg involute fine-pitch system as well as such subjects as factors which determine minimum hob radius, tolerances, inspection, sharpening, plus data on nonstandard fine pitch hobs and on noninvolute hobs. Illustrated with charts, photos and diagrams to supplement text. Illinois Tool Works, 2501 N. Keeler Ave., Chicago 39, Ill. **L-7-3**

Steel Hardening

Technical Bulletin No. 500 "Present Status of Austempering and Martempering" authored by company metallurgist, C. D. Mehrkam, sums up progress made to date in this heat treating field; written for both metallurgist and layman, bulletin outlines history of development, reasons for using this treatment, factors to be considered in selecting specific treatment, required equipment, recent developments, typical examples of treated work. Ajax Electric Co., Frankford Ave. at Delaware Ave., Philadelphia 23, Pa. **L-7-4**

Barrel Plating

Illustrated folder discusses automatic control of barrel plating tank operation through use of Hoffman automatic cut-off plating switch, stressing resultant speed, efficiency and economy. Hoffman Plating Co., 6804 Park Ave., Cleveland 5, Ohio. **L-7-5**

Milling Cutters

Eight-page bulletin 121 describes unground multiple thread milling cutters and their application in metalworking processes; includes latest tolerances and classifications standardized by Metal Cutting Tool Institute; plus engineering and maintenance data. Goddard & Goddard Co., 12280 Burt Rd., Detroit 23, Mich. **L-7-6**

Precision Tools

Pocket-size Catalog No. 8 presents 160 pages illustrated with sectional drawings, application photos, charts and reference tables covering line of precision tools such as micrometers, gages, indicators, calipers, steel rules etc.; also includes general engineering tables useful to users of these tools. Lufkin Rule Co., Saginaw, Mich. **L-7-7**

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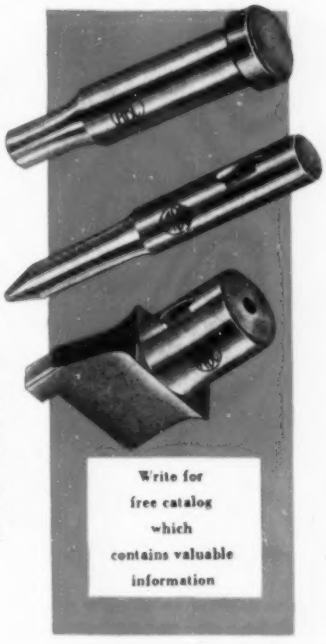

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Stainless Wire

Thirty-two page manual contains data to aid in selection of proper stainless steel wire to meet particular specifications; discusses three group classifications—austenitic, ferritic, and martensitic—lists common uses and end products for each; also includes specifications and engineering data such as chemical analysis and characteristics, physical and mechanical properties. Cruicible Steel Co. of America, P. O. Box 88, Pittsburgh 30, Pa. **L-7-8**

Lathe Centers

General catalog of centers made expressly for lathes illustrates and describes Red-E line; covers shank, spindle, bull and pipe type centers with specifications and prices for each; includes model numbers, tapers, straight shank diameters, load ratings, heads, points and other engineering data; presents pertinent engineering and technical information. The Ready Tool Co., 554 Iranistan Ave., Bridgeport 5, Conn. **L-7-9**

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Optical Alignment Equipment

Data booklet, "The Axicon; a New Optical Element", explains Kodak's optical development and discusses its application to alignment problems; illustrated by drawings and diagrams. Special Products Sales Div., Eastman Kodak Co., 343 State St., Rochester 4, N. Y. **L-7-10**

Whiteprinting

Extensively illustrated brochure presents details about company's automatic whiteprinting equipment designed for high-speed production at speeds up to 70 fpm. The C. F. Pease Co., 3809 N. Rockwell Ave., Chicago 18, Ill. **L-7-11**

Keyway Broaches

Complete specifications and data on 25 different keyway broach kits, 23 standard sizes of broaches and 71 standard size bushings presented in illustrated catalog; also covers stock line of high-speed steel square broaches and in addition offers full details on Minute Man magnetic base; contains useful reference information on keys and keyways. The du Mont Corp., Greenfield, Mass. **L-7-12**

Aluminum

Eighty-page brochure, "Process Industries Applications of Alcoa Aluminum," presents three important phases of subject: describes process applications of metal by industry and product; offers comprehensive directory of performance of aluminum with various chemicals; and discusses latest information on mechanical and technical c nsiderations involved when designing aluminum processing equipment. Extensively illustrated. Request only on company letterhead directly from Aluminum Co. of America, 761 Alcoa Bldg., Pittsburgh 19, Pa.

Threading Tools

Bulletin No. G-96-1 provides detailed information on the Lanroll thread rolling attachment pointing out design features, construction, applications, advantages; tabulates specifications and dimensions; illustrated. Landis Machine Co., Waynesboro, Pa. **L-7-13**

Vibration Control

Illustrated folder, Bulletin K4A, gives engineering specifications and performance data for all of company's vibration, shock and noise control products; installation photos show versatility of application of isolation units; easy-to-read selector chart covers wide range of equipment. The Korfund Co., Inc., Long Island City, N. Y. **L-7-14**

Gage Blocks, Accessories

Loose-leaf, 28-page catalog "Precision in Millionths" describes complete product line of Ultra-finish rectangular and Hoke type gage blocks in steel and tungsten carbide with accessories; includes advantages of "Ultra-finish" process; contains technical data including information on care and handling of tools, typical applications. Dept. M-45, Fonda Gage Corp., Stamford, Conn. **L-7-15**

Slitters

Twenty-four page illustrated booklet 898-S-2 describes line of gang slitters and accessory equipment for warehouse and factory use; covers standard and custom-engineered equipment including hand-operated tools, bench mounted machines and units for fully automatic lines; includes specification tables and other pertinent details. Request only on company letterhead directly to Waterbury Farrel Foundry & Machine Co., Waterbury, Conn.

Investment Casting Alloys

Chart designed to serve as a ready reference guide for engineers concerned with selection or specification of investment castings lists standard investment casting alloys; tabulations cover stainless, low alloy and tool steels, nickel alloys, copper base alloys and aluminum alloys with complete chemical analysis and mechanical properties of each plus ratings as to castability, machineability, corrosion resistance and other characteristics. Precision Metalsmiths, Inc., 1081 E. 200th St., Cleveland 17, Ohio. **L-7-16**

Carbide Products

Easy-to-use 33-page catalog covers carbide tips, tools, throw-away blanks and holders; carbide equivalent charts help in grade selection and application; well illustrated. Valenite Metals Corp., Box 205, Royal Oak, Mich. **L-7-17**

Tooling Resins

Brochure presents outline-descriptions of line of Epocast® tooling resins as to properties and characteristics, uses and technical bulletin reference which will provide detailed information. Furane Plastics, Inc., 4516 Brazil St., Los Angeles 39, Calif. **L-7-18**

Carbides

Simple grade selection chart lists grades of company's carbides tabulating their hardness ratings, transverse rupture points and recommended uses. Firth-Loach Metals, Inc., Buttermilk Hollow Rd., West Mifflin Boro, McKeesport, Pa. **L-7-19**

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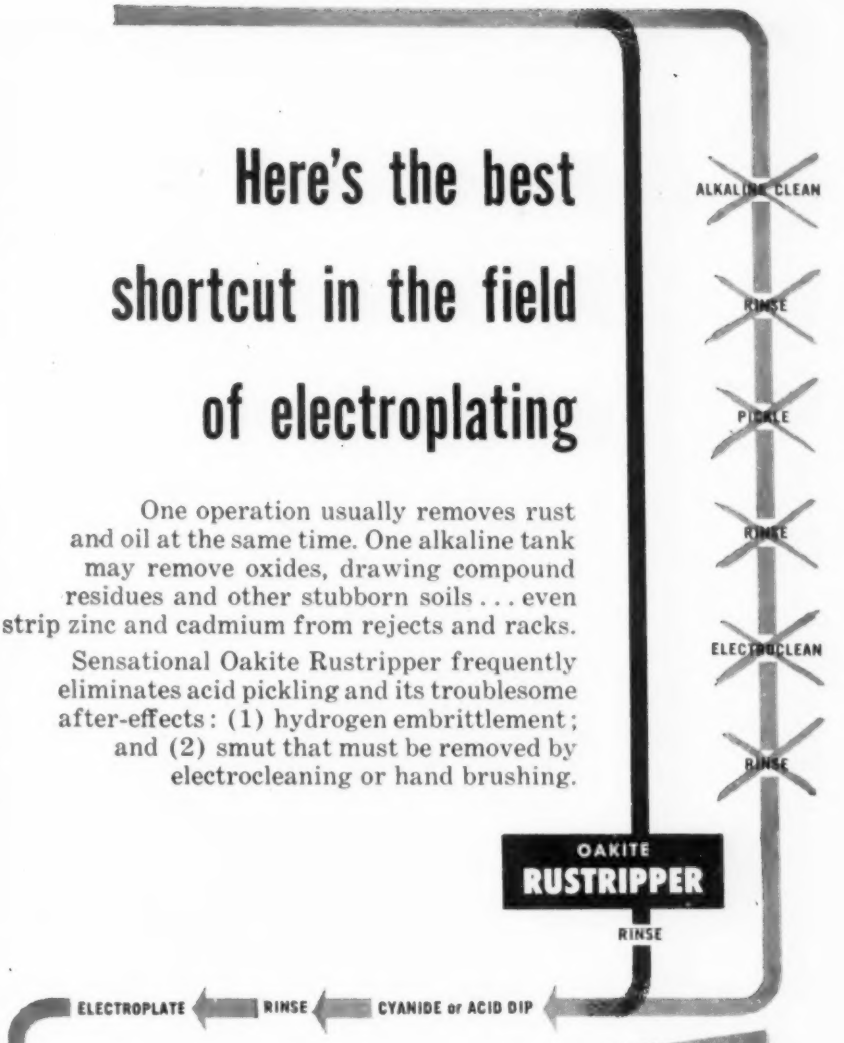

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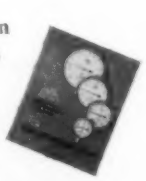

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abstracts of FOREIGN LITERATURE

By M. Kronenberg
Consulting Engineer

Vibration of End Mills

Transversal vibrations of end mills are more important than torsional vibrations in their effect on tool life and work accuracy, according to an investigation made by L. Peithmann, which is reported in the May 1955 issue of *Werkstattstechnik und Maschinenbau*. The author has run a great number of tests, using strain gages and a torque-dynamometer. Vibrations were investigated by attaching strain gages to the shank of the end mills. Two dry cells were attached for the purpose of simplifying the wiring and connection of the Wheatstone bridge.

Cutting force tests and vibration tests were carried out separately. Cutting force tests with the new instrumentation confirmed Schlesinger's cutting force equations for milling cutters established about 25 years ago. This agreement is excellent, particularly for cases where the circumference of engagement of cutter and work lies within the practical range.

The vibration tests were run in order to find out whether vibrations occurring in end milling operations are similar to those occurring in turning operations. In turning operations often the so-called "self-excited" vibration causes breakd wn of the cutting edge and other difficulties. It has been unknown whether this type of vibration also occurs in end milling operations.

The author found that end milling vibrations are different in type from those in turning. He also found that the reason for this discrepancy between milling and turning vibrations is due to the fact that a helical milling cutter edge or the simultaneous engagement of several straight edges on a milling cutter provides a "support effect" (Stuetzwirkung). This increases the natural frequency of the cutter above that of a cantilever. The effect has been investigated by the author and is discussed at length in the report.

Since self-excited vibrations are often difficult to control—they occur in turn-

g operations and in end milling with single straight edge in engagement— is advisable to use helical cutting iges where such vibrations occur less adily. Their appearance depends on he length of the end mill projecting eyond the chuck and the dimensions f the cut.

The tests included investigations of the effect of the cutting speed, clearance angles, wear land, interrupted cutting actions and other items. In general it was found that the amplitude of vibration increased with the cutting speed and that a clearance angle of 1 deg was the worst as far as vibration was concerned. The amplitude of vibration decreased to about 50 percent when the clearance angle was increased to 12 deg. The effect of such a clearance angle on tool life is not discussed in the paper, however.

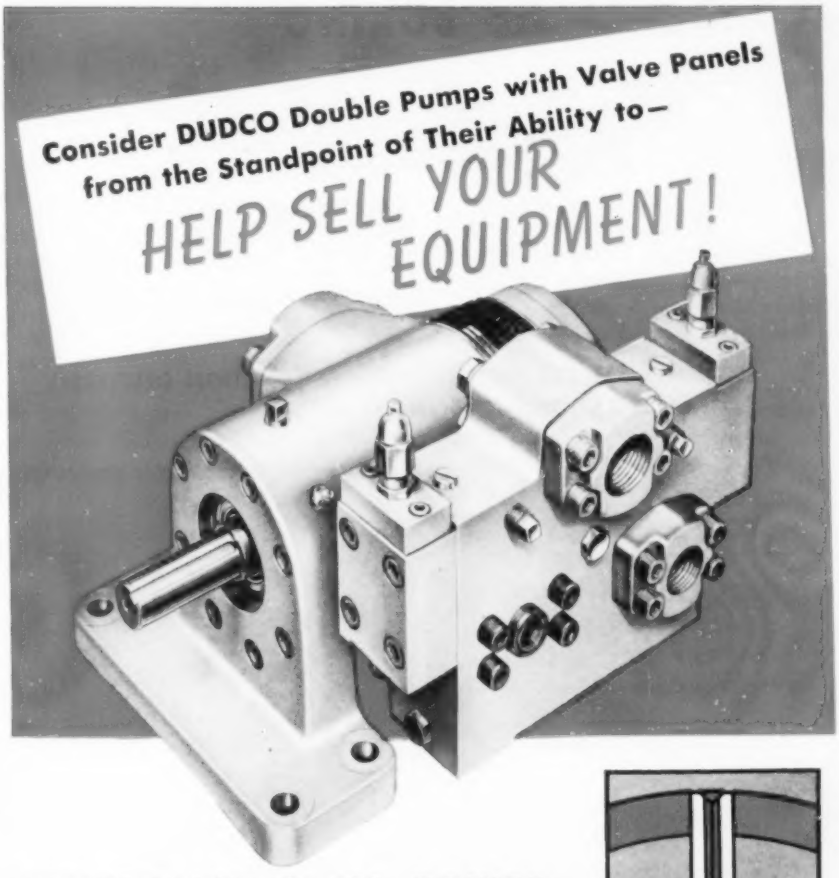
An increase in the wear land likewise was detrimental to good cutting conditions, because of vibration. In case where the milling cutter was cutting on the circumference and also at the face, the author found considerable damping of vibration. The vibratory stresses were found to be as high as 37 percent of the maximum stresses due to the cutting action at about 90 fpm cutting speed and may become even higher with carbide cutters.

Wear Land and Tool Life

J. Witthoff, who is associated with the Krupp-Works, has made studies on the effect of the wear land on tool life taking into consideration the cost of the new tool, the cost of resharpening, etc. He has published his findings in *Werkstatt und Betrieb*, Number 5, 1955, in which he suggests standards for wear land on carbide tools.

The author indicates that his conclusions should be considered only as good approximations and that further investigations are needed for establishing exact data. Since he has suggested different wear lands for various cutting operations, while it is customary in USA to use a wear land of 0.030 inch as a tool life indicator, it seems to be useful to give his suggestions which may eventually be developed into international standards.

For turning operations a wear land of 0.012 inch would apply to light cuts, a wear land of 0.028 inch to medium cuts and a wear land of 0.040 inch to heavy cuts for all materials. For shaving cuts the author suggests a wear land of 0.048 inch, while he would accept a wear land of as high as 0.056 inch for turning tires of railroad wheels with carbides, taking cost factors into consideration. For roll turning operations a wear land of 0.048 inch would be considered as a standard for tool



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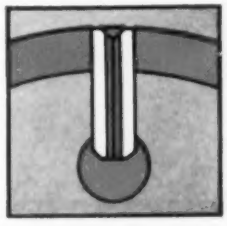

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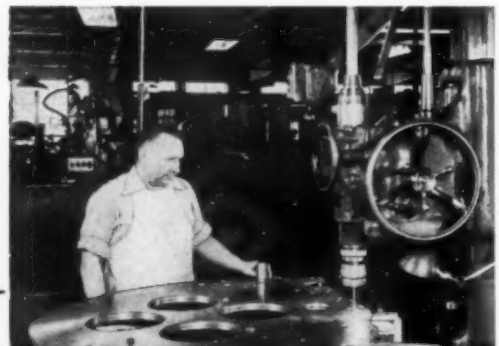

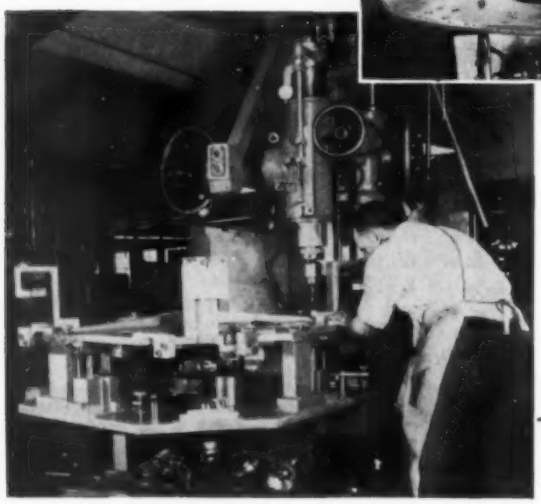

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life. In milling operations on cast iron the tool life would be reached when a wear land of 0.016 inch appeared on the flank, as against a wear land of 0.032 inch in milling steel. When planing, a wear land of 0.032 inch would be taken as the criterion of tool life; this would apply to all workpiece materials. For broaching a wear land of 0.024 inch is suggested.

Development in Diamond Tools

A survey of developments in diamond tools, by P. Grodzinski, appeared in the same issue of *Werkstatt und Betrieb* as the preceding article. The author compares the application of diamond tools in various European countries such as Germany, Italy, France, England and Holland, and also includes some American applications. After discussing the dressing of grinding wheels, the author gives numerous examples of the use of diamonds for precision turning and precision boring operations. In the chapter on diamond wheels for grinding of carbide tools, curves are discussed indicating an increase in tool life by about 100 percent when grinding carbide tools on diamond wheels instead of using silicon wheels. The article contains references to 53 publications on diamond tools.

Standardization of Numbers

Standardization of numbers, though used for many purposes in European industry, has not found many applications in this country. This is due to the fact that the standards have been developed for the metric system, which permits standardization of numbers more readily than the fractional inch system. In a recent issue of the Swiss periodical *Industrielle Organisation*, Issue Number One, 1955, Otto Zollikofer has published an article suggesting methods for including the inch-system into the standardization of numbers.

As an example, in the machine tool industry, the progression of spindle speeds has been standardized in geometrical series using ratios of 1.06, 1.12, 1.41, 1.26, 1.59, 2.00. These series are based on roots of 10, $10^{\frac{1}{40}}$ being the basic ratio. This makes it possible to simplify the design and to produce gears and other parts in greater amounts than otherwise possible. The standards of the numbers are based on simple mathematical relationships and were originally intended for all cases where size relationships were involved. In the English system such standardization could also be used, according to the author, when a relationship of 1:25 (instead of 1:25.4) would be used for conversion of metric and English dimensions. This would apply to cases where dropping the decimal value would not affect essential dimensions.

Technical Shorts...

Process Gives Stainless Qualities to Ferrous Metals

DIFFUSION of chromium into ferrous metals to form a stainless surface alloy to depths from 0.001 to 0.008 inch and more without causing dimensional changes results from a process developed by Alloy Surfaces Co. The process permits ferrous metals to resist corrosion under the most severe conditions; resist thermal oxidation at temperatures to 1700 F, and resist wear and abrasion under a wide variety of difficult applications. The resultant surface will not chip, crack, peel or gall even when the processed product is bent 180 deg, stretched or twisted.

Welding may be utilized before or after processing: mild steel procedures being used before; stainless steel procedures being used after. In addition, they can be brazed, arc welded and spot welded. In spot welding, after treatment, the mild steel procedures are still used. The process makes available parts and assemblies with resistance characteristics at costs less than stainless steel fabrication and it has unlimited applications wherever the advantages of stainless steel are required on large and small metal products including nuts, bolts, washers, clamps, wire specialties, tools, dies, food processing, petroleum, aviation products, automotive and truck and bus accessories and parts, etc. Specification grey iron and malleable iron castings and meehanite can be treated to make castings with corrosion resistance properties too.

* * *

Technique Produces 'Fiber' Metal

SCIENTISTS at Armour Research Foundation have produced a technique called fiber metallurgy that results in production of metal bodies of unusual strength and tenacity. The technique is adaptable to high-speed felting processes similar to those used in paper manufacture, and at costs competitive with those prevailing for powder metal parts.

Suggested possibilities for the fiber metal are filter materials, metal-ceramics, friction materials, electric brushes and, in the aeronautic field, porous deicing systems and porous materials for boundary layer control of air foils.

Develop Test for Metal Coatings

ABRASION RESISTANCE of organic coatings on metals can be measured by a simple rapid method developed at the National Bureau of Standards. In essence, the coating is bombarded, under controlled operating conditions, by a high-speed jet of fine abrasive particles. A time check is made to determine exactly how long it takes to penetrate through the coating to the substrate. Development of the test method was sponsored by the Navy Bureau of Aeronautics in connection with a program for production of highly durable, scuff-resistant finishes for naval aircraft. However, since then a variety of service conditions are readily simulated, and the procedure can be used to determine abrasion resistance on all types of protective coatings.

The abrasive jet method differs from other abrasion test procedures in the ease and rapidity it permits in evaluating materials, and the better reproducibility it allows. The NBS method does not depend upon abrading an area of definite size, and it uses a continuous fresh supply of abrasive particles under closely controlled conditions. End point of the procedure is the first show of bare metal.

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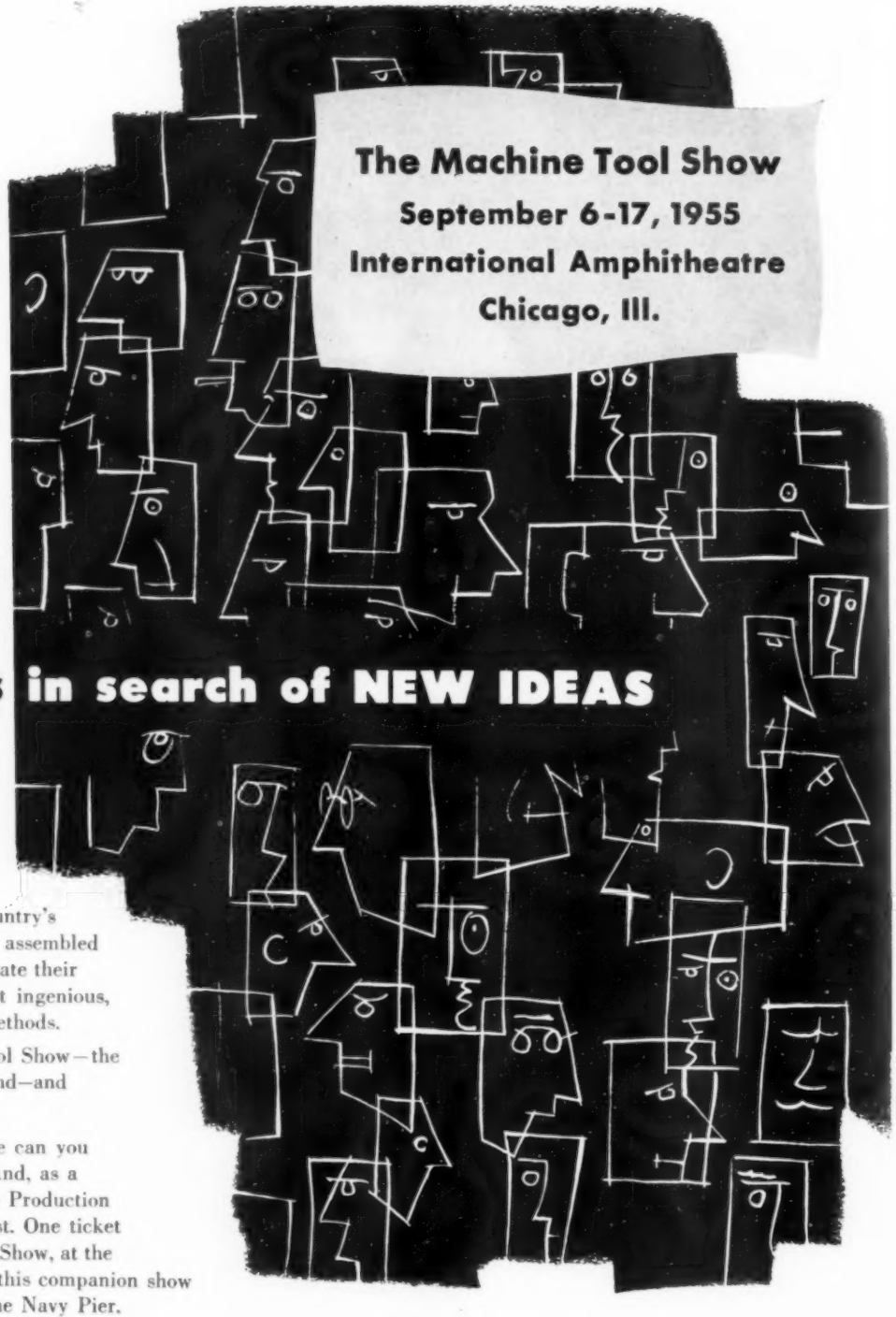

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If you're looking for new ideas, new ways to cut production costs, come to Chicago in September. The 1955 Machine Tool Show is the best chance you've ever had to see **the world's best investment—*in action!***

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Field Notes...

Industry Invests in Atomic Research

Approximately $300-million will be spent on atomic energy research by manufacturers, electric power companies, research institutions and other nongovernment organizations from their own funds during the next four years if predictions of Atomic Industrial Forum, Inc. become fact. The forecast was based on a survey of private atomic energy activities in the United States conducted by the Forum under agreement with the U. S. Atomic Energy Commission. The census includes a breakdown of about $50-million of private money spent before 1954.

Data was supplied for the study by more than 400 private organizations which comprise 75 percent of the total private U. S. atomic energy industry from a dollar-volume point of view. Additional data came from the AEC files and from interviews with top authorities in government and industry.

Growth rates indicate that research and development efforts will continue to increase in size and productivity until they double current rates by 1958. By 1965, when that size and productivity will be doubled again, more than $7.5-billion will have been invested in the United States on reactor construction. Such activity will require an annual consumption of something like 8000 metric tons of natural uranium. As to the outlook of engineers, government and private atomic energy developments will call for a total of 30,000 to 40,000 scientists and engineers or about double the number in both categories today.

From the study it was revealed that between three and five million kilowatts of electric capacity may have to be built and operated on an uneconomic or break-even basis before reactor-generated electric power can become competitive with conventional power. Only sometime after 1962 will such power plants operate on an economic basis.

purchases

Stockholders of Houdaille-Hershey Corp. at their annual meeting approved acquisition of the assets and business of Frontier Industries Inc. and its subsidiaries. Details of the transaction included the exchange of one and a half shares of Houdaille common stock for each 265,000 shares of Frontier common outstanding.

V V V

The Colson Corp. has become a wholly-owned subsidiary of Great American Industries, Inc. through an exchange of stock of the two companies. At the same time that announcement was made, it was revealed that an agreement which Colson had entered into with F. L. Jacobs Co. earlier this year had been rescinded by mutual consent. Under the present agreement with Great American, Colson will maintain its corporate identity. Robert A. Pritzker will remain as president and the current management team will be retained.

V V V

Announcement from Teer, Wickwire and Co. has revealed that company's purchase of the Lindberg Air and Hydraulic Cylinder Div. from Lindberg Engineering Co. The transaction covers the entire stock, machinery, de-

name changes

The name of The Alpha Corp. has been changed to The Alpha Molykote Corp. Reason given for the change was that it now reflects the primary activity of the company.

V V V

Announcement of the name change of Micro-Precision, Inc. to Micro-Precision Div. has been announced by Micromatic Hone Corp. At the same time, the company named Frank J. Hoder, Jr. as general manager of the division.

anniversary

Seventy-fifth anniversary of its operation is being celebrated by Butterfield Div. of the Union Twist Drill Co., one of the pioneers of the metal cutting industry. From its founding in 1880, and incorporation in 1913, the company has expanded from hand made wagon wheel axle cutters to the present day manufacture of precision made cutting tools. Now a nationwide network of company maintained warehouses, sales rooms and independent distributors channel the tools to users.

Members of the National Machine Tool Builders Association's Machine Tool Show Committee presented plans for the September event to its membership at the organization's annual meeting. Participating in the presentation were: (front row) W. E. Rutz, Giddings & Lewis Machine Tool Co., M. A. Hollengreen, Landis Tool Co., and who's president of NMTBA, and Frank U. Hayes, The Bullard Co. (Rear row) James C. Hebert, Jones & Lamson Machine Co., Donald H. McIver, Ex-Cell-O Corp., Frank Moran, The Carlton Machine Tool Co., Stanley A. Brandenburg, The Monarch Machine Tool Co., and Burnell A. Gustafson, Sundstrand Machine Tool Co.

signs and development work of the division. One feature of the agreement is that Teer, Wickwire will take over the entire field sales organization of the division and will immediately begin marketing air and hydraulic cylinders under the Lindberg name. The new operation will be set up as Lindberg Air and Hydraulic Div. of Teer, Wickwire and Co.

V V V

All patents, designs for which patents have been applied, special production equipment, manufacturing and sales rights to the line of Westberg Colletmandrels were involved in the exchange when Erickson Tool Co. purchased The E. Westberg Corp. Operations are being transferred to Erickson's plant at East 23rd and Hamilton Ave. in Cleveland.

Majority interest in Johnson & Hoffman Mfg. Corp. has been acquired by Superior Tube Co. Jay H. Johnson, president, and Eugene J. Hoffman, vice-president, will continue in direct charge of the purchased company's operations.

sales

Executive sales positions at Climax Molybdenum Co. have been filled by John F. Robb and Vernon H. Patterson. Mr. Robb became head of steel industry sales, while Mr. Patterson was named manager of foundry sales.

V V V

L. Buell Manning has been appointed vice-president in charge of sales for A. C. Wickman, Ltd. of Toronto, Ontario. Mr. Buell, who joined the company in 1943, and who has been a director since for the past year, most recently held the post of sales manager. He is a member of ASTE's Toronto chapter.

V V V

In order to improve service to West Coast socket screw distributors and customers, The Bristol Co. has appointed D. J. Yates as its field representative in Los Angeles. His headquarters are at 2181 E. 25th St., Los Angeles.

V V V

Harry Cubel has been made manager of the chain saw sales, Atkins Saw Div. of Borg-Warner Corp. He will supervise Atkins chamfer chain sales and service throughout the United States.

V V V

To improve its technical service to titanium users located in the west, Rem-Cru Titanium Inc. has transferred J. A. Manfre to the West Coast as supervisor of technical sales service. Mr. Manfre formerly was supervisor of process engineering and control at the company's Midland Plant and is experienced in production and quality control. In his former capacity, he is succeeded by D. R. Luster who previously was supervisor of development engineering.

V V V

In a combined announcement, distributors of Delpark industrial filters, Industrial Filtration Co., and Olson Filtration Engineers, Inc. announced the signing of an exclusive franchise authorizing Delpark to handle sales for the Olson pressure type filters in the metalworking and industrial fields. Consequently, effective immediately, these filters are available through Delpark representatives.

expansions

Howe & Fant, Inc. have moved their manufacturing operations into a modern plant at 20 Fitch St., East Norwalk, Conn. The new facility which is equipped with the latest type equipment for efficiency and precision in manufacture, makes possible increased present production and provides adequate space for further future expansion.

V V V

Enlarged, improved facilities for design and manufacture of materials handling equipment have been put in service by Heppenstall Co. These operations have now been transferred from the company's main plant in Pittsburgh to New Brighton, Pa., where a former forgings plant has been virtually rebuilt

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for this purpose. The new facilities provide adequate quarters for the engineering and sales departments of the materials handling equipment division.

v v v

Keeping step with Western industrial expansion, DiEugenio Tool Center has doubled the floor space of its Phoenix, Ariz. headquarters by expanding into larger quarters at 119 S. 11th Ave. The firm's Denver, Colo. offices also have moved to a larger area at 3422 E. Colfax Ave.

v v v

Beloit Tool Corp., which was organized January 1 of this year, has acquired a new plant in Beloit, Wis. The facility, now under full production, is being operated by the firm's Regal Div. The firm is headed by Kenyon Y. Taylor, former vice-president and general manager of Besley Wells Corp.

v v v

Another new plant has been completed and occupied by Allied Products Corp. according to recent announcement. It serves as headquarters for the company's Richard Brothers Punch Div. and Hercules Punch Div. and centralizes all engineering, sales and service activities. The building is located in Redford Township, just west of Detroit city limits.

v v v

Facilities and personnel of Wesson Co. research and development departments are to be housed in a new building now under construction adjacent to the Wesson plant in Detroit.

new services

Glass bead filter calibration services are being made available on a fee basis from The Pall Filtration Companies. The service was instituted in response to demand for certainty in critical filtration in order to evaluate filter performance.

v v v

A Grinding Methods Laboratory has been set up at Mattison Machine Works in order to introduce new services to metalworking plants wishing to study production techniques. More than 50 different machines for production and toolroom grinding are available in the laboratory so that answers to manufacturers' grinding problems or questions may be obtained under close duplication of field conditions.

v v v

Manufacture of solid carbide cutting tools will be carried on by a newly organized company in Detroit, called The Grawell Carbide Tool Co. The new firm is located at 5680 Twelfth St.

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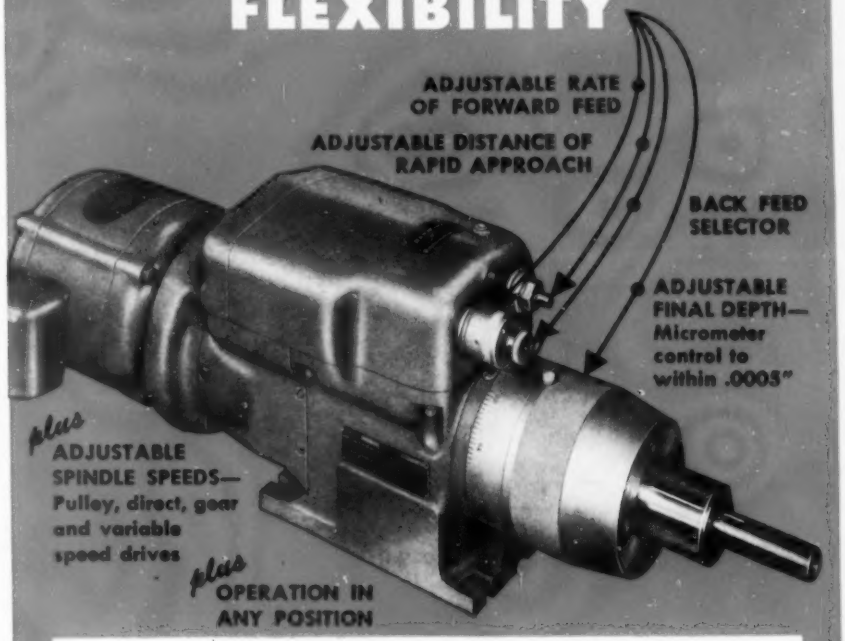
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Who's Meeting - and Where

July 12-14. Western Plant Maintenance Show, to run concurrently with Western Plant Maintenance and Engineering Conference, Pan Pacific Auditorium, Los Angeles, Calif. For full particulars, write show producers, Clapp & Poliak, Inc., 759 Monadnock Bldg., San Francisco 5, Calif.

Aug. 22-23. Stanford Research Institute and National Industrial Conference Board, cosponsors of the Symposium on electronics in automatic production, Sheraton-Palace, San Francisco, Calif. Obtain further information from Public Relations Dept., Stanford Research Institute, Stanford, Calif.

Sept. 6-17. National Machine Tool Builders' Association. Machine Tool Show, International Amphitheatre, Chicago, Ill. Details concerning the exposition are available from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

Sept. 6-17. Production Engineering Show, to be held in conjunction with the Machine Tool Show, Navy Pier, Chicago, Ill. Particulars may be had from show managers, Clapp & Poliak, Inc., 341 Madison Ave., New York, N. Y.

Sept. 6-17. Coliseum Machinery Show (formerly Metalworking Machinery & Equipment Exposition), Chicago Coliseum, Chicago, Ill. Write for details to Chester L. Wells, general manager, Exhibition & Convention Management, Inc., 2689 E. Overlook Rd., Cleveland 6, Ohio.

Sept. 12-16. Instrument Society of America. 10th annual instrument conference and exhibit, Shrine Exposition Hall and Auditorium, Los Angeles, Calif. Details are available from exhibit manager Fred J. Tabery, 3443 S. Hill St., Los Angeles, Calif.

Sept. 14-16. Porcelain Enamel Institute. 17th annual Shop Practice Forum, Ohio State University, Columbus, Ohio. Further details on program

plans are available from institute offices, 1145 Nineteenth St., N. W., Washington 6, D. C.

Sept. 15-18. Packaging Machinery Manufacturers Institute. Annual meeting, Homestead, Hot Springs, Va. Complete details are available from institute office, 342 Madison Ave., New York 17, N. Y.

Sept. 20-22. Society of Industrial Packaging and Materials Handling Engineers. Tenth annual Packaging & Handling Exposition, Kingsbridge Armory, New York, N. Y. For details, contact society offices, 111 W. Jackson Blvd., Chicago 4, Ill.

Oct. 5-9. World Plastics Fair and Trade Exposition, Los Angeles, Calif. For more information, write World Plastics Fair and Trade Exposition, 8762 Holloway Dr., Los Angeles 46, Calif., care of show management.

Oct. 17-21. National Safety Council. 43rd National Safety Congress and Exposition, Conrad Hilton, Congress, Morrison and La Salle Hotels. Details are available from council headquarters, 425 N. Michigan Ave., Chicago, Ill.

Oct. 24-26. American Standards Association and National Bureau of Standards, joint sponsors of Sixth National Conference on Standards, Sheraton Park Hotel, Washington, D. C., to be held coincidentally with 37th annual meeting of American Standards Association. Write for details to ASA offices, 70 E. 45th St., New York, N. Y.

Nov. 2-4. National Fluid Power Association. Fall meeting, Chicago, Ill. Get complete facts from association office, 1618 Orrington Ave., Evanston, Ill.

Nov. 2-5. Stanford Research Institute. World Symposium on Applied Solar Energy, Phoenix, Ariz. Write for details to Director of Public Relations at the Institute, Stanford, Calif.

Nov. 3-6. National Tool & Die Manufacturers Association. National convention and board meeting, Statler Hotel, Detroit, Mich. For more data, contact association office, 907 Public Square Bldg., Cleveland, Ohio.

Nov. 13-18. American Society of Mechanical Engineers. Diamond Jubilee Annual meeting and exposition of power and mechanical engineering, Congress, Conrad Hilton and Blackstone hotels, Chicago, Ill. Write for details to society headquarters, 29 W. 39th St., New York 18, N. Y.

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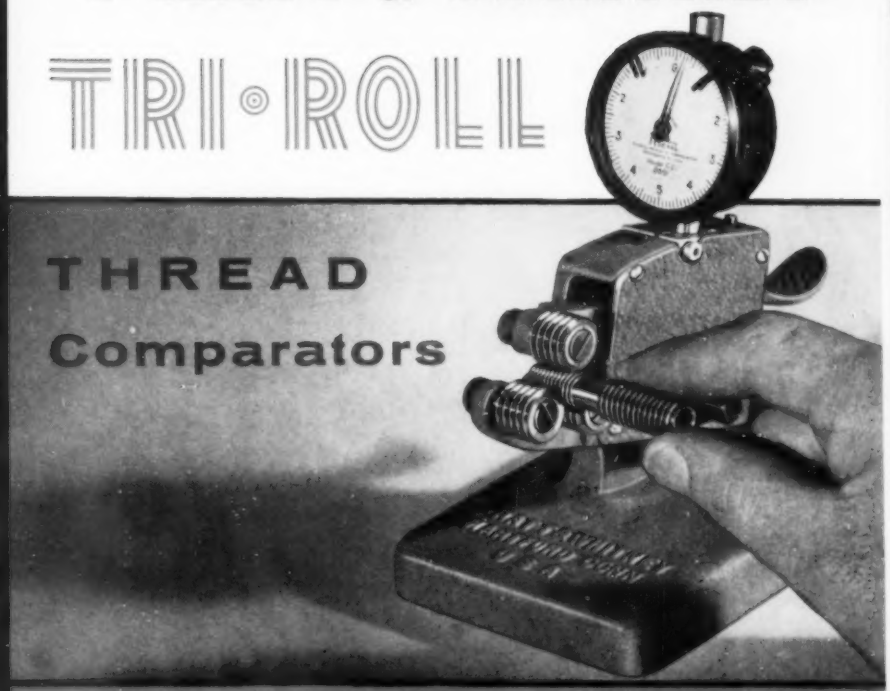

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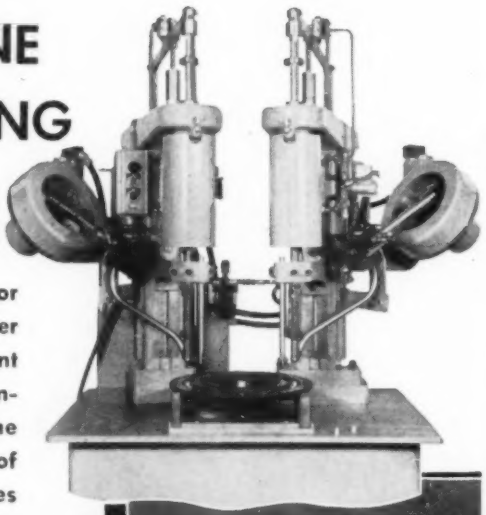

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good reading

PLASTICS ENGINEERING HANDBOOK *of the Society of Plastics Industry, Inc. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $15. 813 pp.*

Engineers and designers will find in this book new methods for testing articles made from plastics and detailed standards for inserts and tolerances of molded articles. Suppliers of plastics raw materials, shop foremen, fabricators and finishers will also find helpful material. A chapter on tooling with plastics describes the newly developed uses of plastics in production tools for the mass-producing industries.

The book is divided into five main sections, covering materials and processes, design, finishing and assembly, testing and SPI standards.

CHIP BREAKERS *by Erik K. Henriksen. Published by the National Machine Tool Builders' Association, 2071 E. 102nd St., Cleveland 6, Ohio. Price 50c. 22 pp.*

The results of a study of three-dimensional chip flow are reported in this booklet. The findings apply equally well to lathes, automatic and turret lathes, boring mills, automatic bar machines, planers, shapers, etc.

The research project which resulted in publication of this report is the first attempt to determine for cuts in various grades of steel what dimensions control the form of the chip, and to suggest the best rake and clearance angles and to give the toolroom a simple rule to insure optimum results as to chip form and tool life.

NICKEL IN IRON AND STEEL *by A. M. Hall. Published for the Engineering Foundation by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price $10. 595 pp.*

This book contains reviews and correlations of all important published data on nickel as an alloying element in steel and cast iron. The introduction is concerned with the occurrence and refining of nickel ores. Remaining material concerns such topics as: the structure and heat treatment of wrought

and cast nickel steels, and the effect of nickel on various engineering properties. Each chapter is concluded with a summary.

MONOMERIC ACRYLIC ESTERS *by Edward H. Riddle. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. Price $5. 221 pp.*

The book begins with a brief history of acrylic monomers and polymers, including the process used in preparing monomeric acrylic esters. Physical properties of the technical grades and purified materials are then presented, together with methods of removing inhibitors, explosive limits, toxicity and facilities for unloading and storing of monomers.

Recent advances are covered in all chapters and particular attention is given to the latest theories of polymerization and copolumerization mechanisms involving monomeric acrylic esters.

ENAMEL APPLICATION BY DIPPING *by Paul S. Cecil. Published by Porcelain Enamel Institute, Inc., 1346 Connecticut Ave., N.W., Washington 6, D.C. Price $1. 26 pp.*

This booklet, second in a series of porcelain enamel processing methods, is divided into three main sections. The first deals with general applications and considers accepted methods, as well as advantages and disadvantages of dipping liquid porcelain enamel with rivet and spring tongs, hand dipping, and draining. Another section discusses methods of application such as equipment, enamel control and recirculating dip tanks. The third section discusses the properties of the materials as they affect the draining properties of an enamel.

HANDBOOK OF INDUSTRIAL SAFETY STANDARDS. *Published by Accident Prevention Dept., Association of Casualty and Surety Companies, 60 John St., New York 38, N. Y. Price $1.40. 315 pp.*

This revised book gives a comprehensive coverage of industrial safety requirements recommended by authorities. Much of the test is an extension of the various codes on which it is based, and some sections discuss topics not covered by existing standards.

Among the subjects discussed are: safety programs, accident investigation, materials handling, machine guards, exhaust systems, welding and cutting, radiation hazards and disaster control. Included in the appendices is a table of maximum allowable concentrations of toxic substances and a classification of fire extinguishing appliances.

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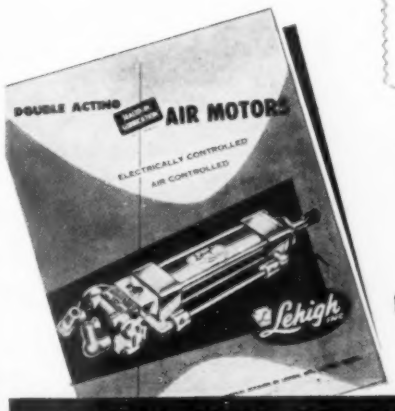

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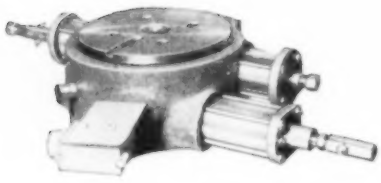

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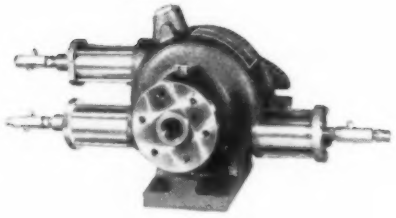

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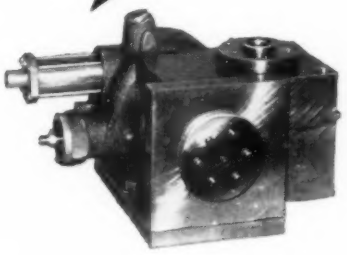

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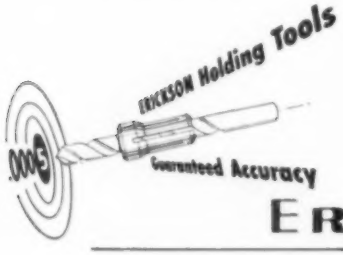

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Making Better Use of Engineers

technical digests

By G. Kleis
Manager, Central Technical Depts.
Westinghouse Electric Corp.
East Pittsburgh, Pa.

MORE ENGINEERING OUTPUT per engineer can be secured if supporting personnel are provided to perform nontechnical and routine aspects of the job. Such purification of the engineer's job stretches his effectiveness, makes for greater job satisfaction and gets the routine work done more economically. There are already many clearly defined job classifications in industry at the subprofessional level. These include draftsmen, manufacturing information writers, production clerks, inspectors, testers, lab and service technicians, order service clerks, technical writers, and many others. Whereas these functions once were performed by graduate engineers, they are now almost universally handled by technicians and clerks. This is progress.

To further emancipate professional engineers, all that is needed is to continue this trend to isolate areas of work which can be performed satisfactorily by less high trained personnel. The first step is a careful analysis of duties assigned the engineer. At Westinghouse a group participation method is used in which engineers make their own analysis, *Fig.* 1. Thus they feel it is their own program rather than something management is forcing upon them.

A pilot study is cited which eventually became a standard pattern for use throughout the company. A typical engineering design section in the Generator Engineering Department was selected for the study. There were nine engineers in the section without clerks or technicians. Department-wide service provided secretarial help, filing clerks, draftsmen, and general duty clerks. Up to the time of the study, three years ago, it was presumed that this group was doing only work properly assigned to professional engineers.

The objective of the study was to determine what part of the engineers work could be delegated, and what type and quality of assistance was needed. Specifically, the study was intended to answer the following questions:

1. What jobs or parts of jobs now done by graduate engineers could be delegated to a clerk or nonprofessional technician with a saving in engineers' time?
2. How many man-hours of engineering time could be saved?
3. How many man-hours of supporting help would be needed?
4. What training and experience would be required of that supporting help?

Examples of the types of work that might be delegated were suggested to the group, such as: looking up established data, locating order papers, drawings and other references, making routine design calculations, filling out multiple records, analyzing test data and recording results, etc.

Some of the results of the survey are shown in TABLE 1. The total indicated saving was 13.9 man-days in the two-week period, or 15.5 percent of the engineers' total time. Allowing for lower efficiency of the clerk or technician, it appeared that the section could utilize an experienced technician four days per week and a clerk 3.9 days per week. The data gathered in the survey were useful in setting down a statement of training time, experience and personality requirements of the two positions. Competent supporting help was acquired and experience to the present has indicated a very nearly optimum balance. Through cooperation of the engineers, supporting personnel have been able to handle more responsible assignments than original survey had indicated. It appears that the output of the section has increased by at least 15.5 percent expected. Application of this technique has resulted in savings in several other sections.

"Fringe-Area" Jobs

In many "fringe-area" jobs engineers have been used though nontechnical college graduates can perform them successfully with training. Such jobs in manufacturing industry include semi-technical sales purchasing, production planning and control, time and motion analysis, quality control, industrial relations, etc.

Because engineers have performed so successfully in these jobs, local managers were reluctant to accept others. The top management, however, harbored the conviction that business and liberal arts graduates, if well selected and trained, could sell themselves to the local managers. Therefore, 125 nontechnical graduates were hired for the graduate student-training program in 1952, along with 375 engineers. Their training was essentially the same except for a six-weeks' product school, and a brief course in engineering fundamentals. They were placed on a series of work assignments in the "fringe-area" departments. The local manager soon

Fig. 1. Conference in which nontechnical assistance needs of a small engineering group are being surveyed.

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became enthusiastic. Many said they will continue to ask for such men even if engineers again become plentiful. Each year since an average of 100 nontechnical men have been taken into the company in the same manner. This, in effect, gives more mileage on the engineers that are brought in through the trained programs since they no longer need be sacrificed to "fringe-area" positions.

Industrial Training Program

Another step taken to produce long-range increase in engineering effectiveness is a program of continued education to raise proficiency levels of both engineering and supporting personnel. This plan is known as the Westinghouse Educational Assistance Program.

Management encourages each employee to plan a self-development program. Hence, a wide range of educational programs is provided to fit varying needs of personnel. The graduate study program provides continued educational opportunities for professional employees in advanced degree work. Engineering, science and business administration are provided through affiliated universities.

Business and management program is unique in providing high-level undergraduate business administration courses designed specifically for engineering and science graduates. This leads to a certificate and qualifies participants to enroll in regular graduate business administration courses at affiliated universities.

Undergraduate programs in engineering and business administration are available to qualified young employees who desire to secure a college education.

Technical institute program is available to high school graduates with an aptitude for and desire to become technicians. The aim is to assist capable young employees toward a technical career and to help meet the need for technicians in the shop and laboratories, and to supply supporting personnel to engineering and service organizations.

By these training programs not only does management provide educational opportunities and encourage participation, but the company makes a substantial contribution to the cost of the programs by refunding tuition.

The proficiency level of all personnel, including technicians, can be increased substantially through such an educational program. By adding a good facilities program, including computers, tremendously improved mileage performance can be expected of professional engineers.

Table 1—Time Required by Technician to Perform Work Delegated by Engineers in Two-Week Period

	Minutes Saved		Factor		Minutes Spent	% of Time
1. Design Calculations	1705	x	1.25	=	2130	55.3
2. Write S.O. Title & Dev. Sheet	330	x	1.0	=	330	8.6
3. Read and answer letters	270	x	1.25	=	337	8.7
4. Look for drawings & other ref.	145	x	1.0	=	145	3.8
5. Review references	115	x	1.25	=	144	3.7
6. Confer on mixed apparatus	105	x	1.25	=	130	3.4
7. Write D. Spec.	90	x	1.1	=	100	2.6
8. Confer on design details	47	x	1.1	=	50	1.3
9. Schedule work	45	x	1.0	=	45	1.2
10. Confer with test floor	30	x	1.1	=	33	0.9
11. Check contracts and G.O. papers	15	x	1.0	=	15	0.4
12. Miscellaneous	390	x	1.0	=	390	10.1
	3287				3849	100.0

$$\text{Ratio} \frac{\text{Technician's Time Spent}}{\text{Engineering Time Saved}} = 117\%$$

From a paper, 55-MGT-8, "Get More Mileage from Your Engineers," given at the ASME management conference, March 24, 1955.

▼ ▼ ▼

Mechanical Design for Automatic Production

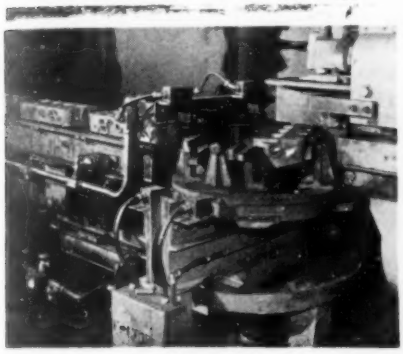
By William R. Slattery
Manufacturing Engineering Office
Ford Motor Co.
Dearborn, Mich.

Principles of automation utilizing conveyors, plus the gradual development of the transfer type machine, have today reached their maturity in that new programs are based on the use of machinery and equipment which have been designed with automation in mind. When the machinery is selected, it is based on the use of the transfer machine. Its location in production facilities is based on the utilization of automation between the transfer ma-

chines wherever it is practical and economical to do so.

In discussing mechanical design, there are no rules which will automatically make a man a good designer. However, there are at least two basic elements to consider to lead to an ultimate goal of reliable, trouble-free and economical equipment installations.

First of all, men must be suited for the job of mechanical design engineer. A designer of automatic production equipment must have imagination, engineering knowledge, and design experience. A second element is a series of principles and practices which should be followed by the design engineer in carrying out requirements. The first



Air-Operated turn-table turns a cylinder head completely around in the same plane after broaching operations and pre-positions it for drilling.

is planning equipment for automatic production.

Designs begin to take form in the early stages of the plant layout development and the designer must be on the job so that arrangements can be made for the installation of the simplest type of mechanism. It is the time for quick calculations and simple sketches to help determine in a preliminary way the extent of automation which is justified by the economics and other related factors. The part to be produced must be carefully studied for adaptability to automation. Preliminary manpower estimates must be considered.

An over-all preliminary automation layout is made to show all of the elements required. In some cases, models and three-dimensional drawings are made to be certain of some of the details and to make a proper presentation to management for approval. This preliminary layout is then analyzed for estimated installed cost.

When the program is approved, plant layouts must be revised where necessary so that the automation equipment is allowed adequate space. The Processing Department revises their operation sheets where necessary to include the effects of the automation equipment. The Tool & Die Design Department is consulted so that proper coordination takes place. It is important that clearances are left in dies and tools for introduction of automation devices to load and unload work.

The ultimate goal of a standardization program is to insure machinery and equipment installations which will be trouble-free within reasonable limits. A well-planned standardization program is a necessity to a well-planned preventive maintenance program. In the past, maintenance was based on repairing equipment after it had broken down. This approach is not satisfactory at present. A production system must be geared to a uniform rate per hour without the possibility of making up lost production due to breakdowns.

The starting point of a good maintenance program is in the design stages of the equipment procurement. The designer has a definite responsibility and obligation to use all of the available knowledge in order that the maintenance job will be simpler. Standardization simplifies the procurement

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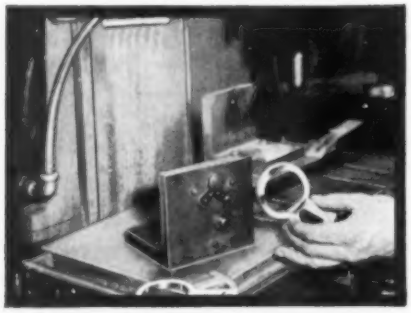
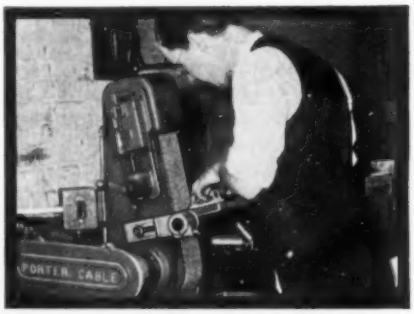
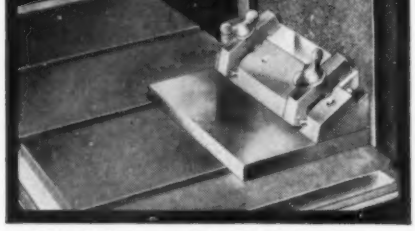


● Facing this thin wall bronze casting formerly took 9 min. on engine *lathe* — now takes 2 min. on wet-belt grinder.



● Generating radii on forged aluminum gun mount stepped up to 120 pcs. per hr. — double rate of *filing*.

● Ammunition box rim originally *milled* for close fitting cap at 33 per hr. — now abrasive belt ground at 89 per hr.



● Angle face on hardened steel cutter bar; output by *surface grinder*, 4 per hr. — by abrasive belt method, 14 per hr.

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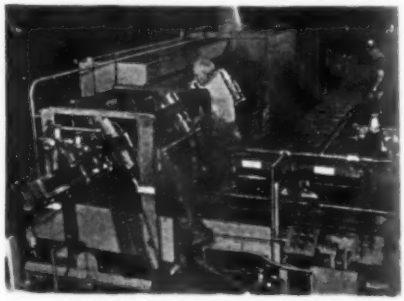
program, and greatly simplifies the problem of keeping adequate supplies in stock for necessary repairs. Another standardization factor is the use of Joint Industry Conference Standards which are a collection of sound engineering and installation practices. They provide detailed specifications for the application of electrical, hydraulic, lubrication, and pneumatic apparatus to machine tools and other industrial equipment.

Often in the past, electrical control panels were supplied in which insufficient consideration was given to safety, identification of apparatus and wiring, accessibility for maintenance, and the exclusion of foreign matter which impaired the operation of electrical devices. In contrast to these shortcomings, the joint efforts of all concerned have today developed electrical control enclosures which are based on standards. Complete electrical wiring diagrams, sequence of operations, and stock lists with appropriate identification cross-referenced with the actual identification of the devices and wiring are now available and accompany the panel. When breakdowns occur, electricians can detect the cause.



An automation transfer mechanism (foreground) feeds cylinder heads to the loading station at left.

Another important feature is standardization of oil reservoirs, and power units. Today, these hydraulic components have been removed from under the machines. The various elements of the control mechanisms are accessible and their operation can be observed while the machine is in operation.

Control systems make it possible for all elements of the machinery and equipment to operate in harmony with each other. The electrical system must be so arranged that a part is loaded into a machine or a work station as quickly as possible after the operational cycle of the machine shuttles the preceding part to another station.

From a paper presented at the Automation-Engineering for Tomorrow Symposium, Michigan State University, East Lansing, Mich., May 13, 1955.

Control Uses Packaged Cybernetics

By W. H. Brandt

Manager Engineering
Director Systems Dept.
Westinghouse Electric Corp.,
Pittsburgh, Pa.

Facing American technology so far as the machine tool industry is concerned is the problem of developing devices with all the desirable properties of relays plus much higher reliability.

One important property of any step function device is that it provides memory. This is one of the principal advantages of a digital control system over an analog system.

Another advantage the relay provides is its comparative insensitivity to changes in other components used in direct conjunction. Since the relay has two stable states of operation, changes in the other components do not affect the state in which the relay is found. Therefore, comparatively inexpensive components like resistors, which show some change in resistance with temperature, may be used. This property is another principal advantage of the digital system over the analog system.

The relay has another advantage which is a great convenience. The output can be made several times the input. This means that a number of units can be operated from each relay and makes it possible to construct complex networks without the use of intermediate amplifiers between stages.

A relay can never have the required degree of reliability. It has moving parts which are subject to wear and has contacts which change with time, erode, and are strongly subject to environmental conditions. The new device to replace the relay must then have no moving parts and no contacts but yet must be a step function device whose output is higher than its input. To make the device commercially feasible, the device must be so designed that it can be easily duplicated millions of times with nearly identical results.

Solid-state phenomena to fulfill these requirements are magnetism and semiconductivity. A material is classified as ferro-magnetic if magnetism is induced in it when that material is placed in a magnetic field. If the field is changed cyclically, the magnetics, induced in the material plotted against the magnetic field gives the familiar hysteresis loop which forms the basis for judging ferro-magnetic materials.

There is a difference between relays and static devices that causes some difference in circuitry. A relay will handle either alternating or direct current in either input or output. To make static devices equally flexible, another component is needed—a rectifier. Two types of static rectifiers are available for use in Cypak system components, selenium diode and silicon diode. These diodes are the basis of logic in Cypak systems. By using rectifiers in combination with magnetic elements or transistors it is possible to duplicate all functions performed by relays. However, this makes the circuitry look quite different in the case of magnetic elements and it also makes the transistor circuitry quite different from that of either magnetic elements or relays.

Components are available in the computer field that perform the same general function. The Cypak system elements for industrial control systems must be more rugged than computer elements by several magnitudes. Such elements must be larger and heavier and built for rough industrial service. Cypak system elements were designed to meet the speed of response demanded, the greater reliability desired, and ruggedness.

In size and weight relays and magneti elements are roughly equivalent, whereas transistorized units are smaller. It is expected that as designs of Cypak system elements are further improved, they will become smaller in size and cheaper than relays. It is not known now how far design simplification can go without sacrificing basic reliability for industrial operating use.

Transistors operate easily in a hundredth of a millisecond, and can be pushed to higher speeds. Relays at best require about 10 milliseconds. Magnetic elements operate easily in one

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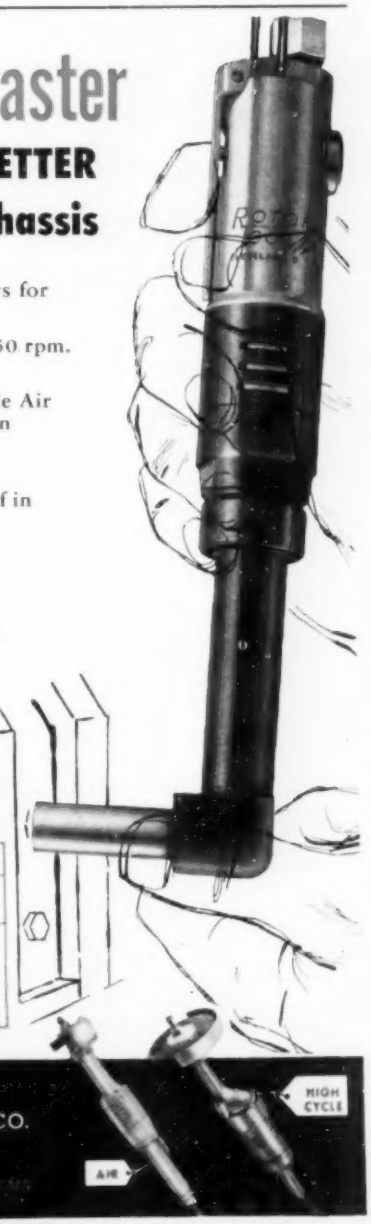

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millisecond where necessary. However, in the case of magnetic elements the time delay is either a full or a half cycle of line frequency so that a 16-millisecond time delay is often used where operating speed is not important.

Transistor and magnetic elements have been designed to operate at very low power levels and save weight, space and complexity. All systems—magnetic, transitor, or relay—require input sensing devices of some sort. Many of these input devices are reliable units but have the disadvantage of not having an output power level high enough to feed directly into relays systems and they require intermediate amplifiers. Two familiar examples are the photocell and thermocouple. Output from these units may be fed directly into Cypak systems without intermediate amplification.

Because the power levels are low, an output amplifier of some sort is usually required for Cypak systems. In principle, this output amplifier can be made up of either transistor elements, or magnetic elements, or relays. However, magnetic elements are generally used only where the reliability factor is of prime importance. Transistors, however, are not yet available in power ratings sufficient for this purpose but probably will be soon.

From a paper presented at the machine Tool Electrification Forum, Buffalo, N. Y., April 19 and 20, 1955.

▼ ▼ ▼

Methods of Reducing Radio Interference of Machine Tools

By C. D. Fahrnkopf

Radio Interference Laboratory
Engineering Laboratories
Westinghouse Electric Corp.
Pittsburgh, Pa.

Suppression of radio interference from machine tools is generally relatively inexpensive if the problem is considered as a part of the machine design. Interference can be reduced by using radio-interference-free components and by using standard or unsuppressed components and then shielding selected components and filtering power leads as required. Neither of these methods is universally applicable and depends on conditions.

Using interference-free components cannot be applied fully in all cases because many components cannot be ob-

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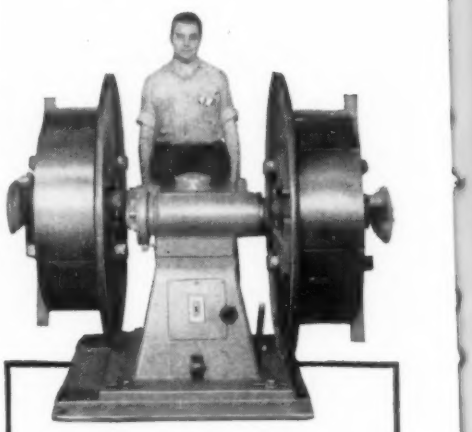

Production *continues* while you reload one side of this Littell No. 25-12 Double Reel. When one coil is used up the reserve coil swivels into feeding position in a matter of seconds. The idle side is reloaded while the working side pays out. Electric Brake with rheostat controls provide an adjustable spindle drag. The Reel Pedestal, mounted on a machined base plate, permits accurate line-up with the center of the die. No. 25-12 takes a 2500 pound coil on each side, and is one of the many Littell Automatic Centering Reels perfectly adapted to pressroom automation.

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ained free of interference.

Shielding and filtering selected components and power leads to the systems is best suited for machine tools having several radio intereference sources. Application of these methods will also depend on how the radio interference is transmitted—by direct radiation or induction.

Sources of interference in the machine tool are mainly a-c and d-c motors. Other sources of interference are dry and gas tube rectifiers and thyratrons.

Although these electrical sources may be easily recognized and controlled, nonelectrical components such as V-belts, machine bearings, and friction clutches generate static charges.

The principles used in the reduction of radiated interference are essentially the shielding of all sources which cannot be eliminated and grounding of anything that might become an antenna. Some rules are:

1. All cover plates should be metal and bonded to the body of machine tool
2. Leads external to the machine tool should be in conduit
3. Place metal oil or air pipes against the machine frame
4. Prevent belt static with conducting or antistatic belts.

To reduce conduction of interference along power supply and any other wiring to the machine tool, use radio interference filters with suitable voltage and current ratings and sufficient attenuation characteristics. Reductions of 100,000 or more are necessary for electrical equipment interference sources of the type used on machine tools.

Manually controlled power switches or breakers should be connected on the line side of filters so that filters will be de-energized when the machine is not operating. Power to lights or other devices which are part of the machine should be connected to the load side of the power line filter. Three-wire plugs (one prong grounded) are receptacles for all utility outlets located on machine should be used.

Radio interference reduction filters should be connected in series with main power supply to control so that the filter does not have to carry motor and other currents. If motors or other main power equipment and control require suppression, the filter can then be connected in the main supply to the machine. This filter should be located so that there will be no electrical coupling between input and output leads to the filter. If the only radio interference source is a low energy device such as fluorescent light, then the filter should be in the power supply for

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this source and mounted at the source. The quality and amount of filtering, as well as shielding, will depend on the intensity of the interference source.

Although all components cannot be designed to be radio-interference-free, it should be considered because of the resulting advantages to all radio communication and even to the operation of the electrical apparatus concerned.

From a paper presented at the Machine Tool Electrification Forum, Buffalo, N. Y., April 19 and 20, 1955.

Fusion Welding Titanium Sheet

By Alan V. Levy
and
R. Wickham
Marquardt Aircraft Co.
Van Nuys, Calif.

The great fluidity of titanium metal in the molten condition lends itself to fusion welding without the addition of filler metal. The resulting welds are flush with the base metal and have high ductility, comparable to the ductility of the base metal. The welded joints can be made by hand or automatic methods. A critical requirement of this type of weld is a close fit of the parts to be joined. The backup and holddown fixtures also have a decided effect on the resulting weld. A sheared surface resulting in a no-gap joint is required for a satisfactory weld. Fused welds have been limited to date to longitudinal tight butt joints in material up to 0.062 inch thick. Further testing and experience should extend the limits of application. Bend tests made on welded samples have bent 180 degrees over a 2T bend radius exhibiting equal or greater ductility than the base metal. Welds tested in tension have exhibited over 100 percent efficiency in all cases. The elimination of welding rod has reduced the amount of contamination in the weld and the weld area.

From a paper, "Fusion Welding Unalloyed Titanium Sheet without Filler Material," presented at the AWS Annual Spring Meeting, June 7-10, 1955, Kansas City, Mo.

▼ ▼ ▼

Quality Control of Spotwelding

By Glenn C. Woodmancy
Boeing Airplane Co.
Seattle, Wash.

Quality control systems for resistance welding have one common factor—proper means for assuring dependable welding machine performance. Experience has shown that service of three-phase spotwelding machines cannot be effectively performed without either the cathode-ray oscilloscope or direct writing magnetic oscillograph. In most cases both are needed.

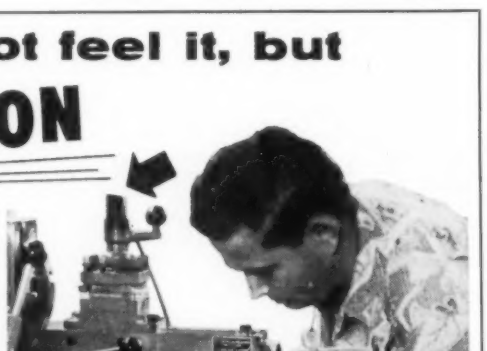
The goal of proper welder maintenance is to isolate the cause of malfunction and correct it rather than to juggle components for a temporary fix. This goal must be achieved for welding schedule reliability.

Three-phase frequency converter welders are particularly suited to the use of the oscilloscope because they can be operated so that various signals recur at a high enough frequency to be read on the oscilloscope. Once operating personnel become familiar with the correct signal patterns at various places in the welder they can diagnose malfunctions.

This paper discusses timing calibration, timing synchronization, current control dial calibration, weld pressure calibration, pressure and current correlation, ignition balancing and timing control check-out.

From a paper, "Oscillographic Instruments in Spotwelding Quality Control and Maintenance," presented at the AWS Annual Spring Meeting, June 7-10, 1955, Kansas City, Mo.

you may not feel it, but
VIBRATION
can wreck your tools



Your hand may never sense it . . . but your balance sheet feels the effect of tool vibration. For vibration destroys tool edges . . . and increases costs . . . until your profits may literally vanish.

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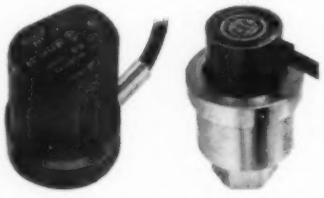

Pickups are available for measurement of either linear or torsional vibration.

Send for "MACHINE TOOLS AND VIBRATION," Bulletin CEC 1555-X1.

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Developing New Materials

By Albert M. Hall
Chief, Alloy Department
Battelle Memorial Institute
Columbus, O.

Because of pressures of demand and necessity, there is a steadily increasing tendency to tailor make a metallic material for a particular use or relatively narrow group of uses.

The bulk of these materials are modifications of existing ones and represent extensions of knowledge in areas of metallurgical technology.

Recent research has resulted in further development of iron-aluminum alloys. One alloy in particular, known as Thermenol, contains approximately 14 percent aluminum, 4-5 percent molybdenum, balance iron. Initial interest resided in its superior magnetic properties and high electrical resistivity. It is characterized by very high magnetic permeability and low hysteresis losses. Because of these properties, the alloy may be satisfactory for electronic applications and as transformer core material.

Such alloys are extremely brittle. However, the higher aluminum alloys can be fabricated if a rigid work schedule is followed carefully. The alloys are forged at 1800 F, and are hot-rolled at 1000 F with approximately 0.005-inch reductions per pass. By further cold rolling, very thin strip material may be obtained.

Rapid advances have been made in titanium technology, in spite of the failure of titanium to live up to initial expectations as a super engineering material for elevated-temperature applications. It is now realized that titanium and titanium alloys will only fill the temperature gap between the light-metal aluminum and magnesium alloys and the heat-resistant iron-nickel, and cobalt-base alloys.

Procedures for the fabrication of titanium are constantly being improved. Forging techniques are well-established, and commercial titanium and the RC 130 A alloy can now be deep-drawn hot or cold. In cold-drawing, intermediate stress-relief heat treatments are necessary because of the work-hardening properties of titanium. Titanium lends itself readily to drop forging (at 1600 F), and has favorable tensile properties for stretch-forming operations for airfoil surfaces.

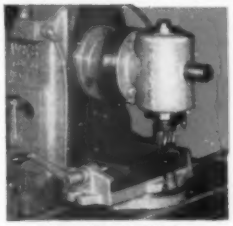
Improvements have been made recently in the field of high-alloy tool steels. These developments have been based on the principle that if elements can be added to engineering steels to make them free-machining, why can't additions be made to tool steels themselves to improve their machinability? Various grades of Mo-W-V, Cr-Mo-V, and high-carbon, high-chromium, high-speed and hot-work steels are available which have been sulfurized to improve their machinability. Substantial savings in tool production can be realized by sulphur additions without adverse effects on toughness and other mechanical properties. Moreover, sulphurized tool steels seem to perform better than conventional types.

Recent developments have been concerned with more extensive application of sintered iron powders for special purposes. The use of these materials for cartridge cases is a example, although this application is still in the development stage. Some success has been attained in deep drawing the pressed and sintered preforms into finished products. Hydrogen-reduced iron powder is normally used for these processes rather than the more expensive electrolytic iron powders.

Mechanical properties of iron powder compacts can be improved greatly by the addition of carbon, nickel, chromium, and other alloying elements. Better properties are obtained if chromium and nickel are introduced in the form of prealloyed powders rather than as the powders of the individual elements.

Interest has continued in the field of precipitation-hardenable stainless steels. These materials are useful for service in steam power plants and aircraft applications at intermediate temperatures.

V-2B alloy, a precipitation-hardenable cast stainless steel is also commercially available. It is useful where high hardness, wear-resistance, and corrosion resistance are important. Anti-galling properties make it useful for valve disks, plug cocks, shaft sleeves,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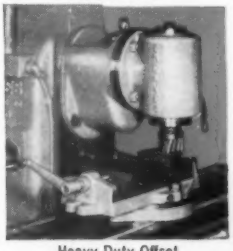
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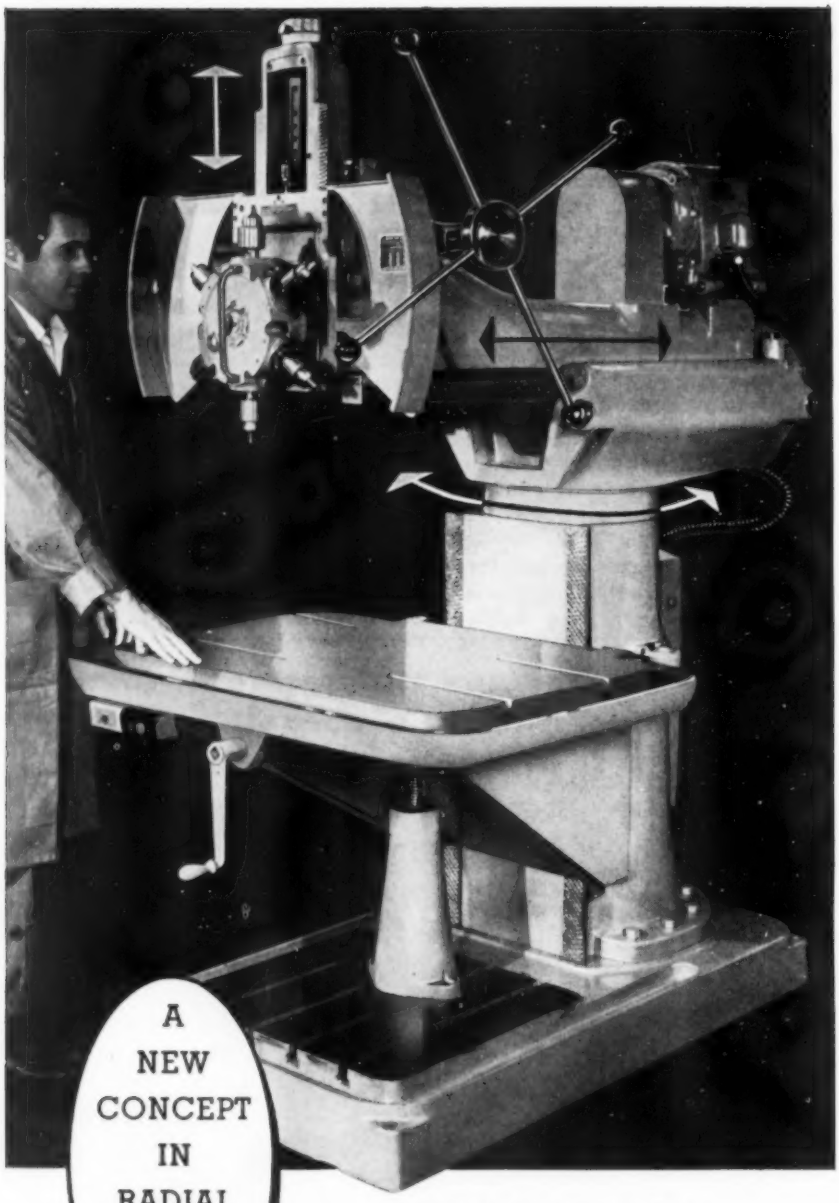

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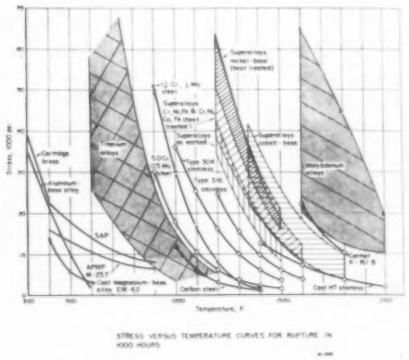
impellers, pump casings, and gear blanks. Maximum hardness is produced by water-quenching from 2000 F and aging for 8 hours at 925 F.

In the past two years, considerable interest has been aroused in the field of aluminum metallurgy by the outstanding high-temperature properties of sintered alumium powder, commonly termed SAP abroad, and APMP in the U. S. This powder metallurgy product has better elevated-temperature properties at 900 F than the best wrought or cast aluminum alloy at 600 F. Excellent high-temperature stability is another characteristic.

In magnesium metallurgy, noteworthy advances have been made in the improvement of casting alloys for elevated-temperature service. Recently



Graphs of 1000-hour rupture stress as a function of temperature for a wide variety of metallic materials (Cross and Simmons). They summarize the useful temperature ranges of the various alloys systems and the relative load-carrying ability.

available Mg-Zr-Th and Mg-Zr-Z-Th alloys have been proven to be superior to the slightly older Mg-rare earth-Zr alloys.

Increasing demands of the aircraft industry for higher jet-engine operating temperatures have led to continuing developments in both cast and wrought high-temperature high-strength alloys. The shortage of cobalt in 1952 caused more attention to be directed toward further development of nickel-base alloys than cobalt-base materials.

Several new vanadium-base alloys are being investigated, but no data are available at the present time. These are reported to have excellent creep properties up to 1650 F, but have very poor room temperature impact strength and ductility. A new cast nickel-base alloy is also being developed, and looks promising.

From a paper "New Materials" presented at the 12th Machine Design Conference of the Cleveland Engineering Society, Feb. 1955.

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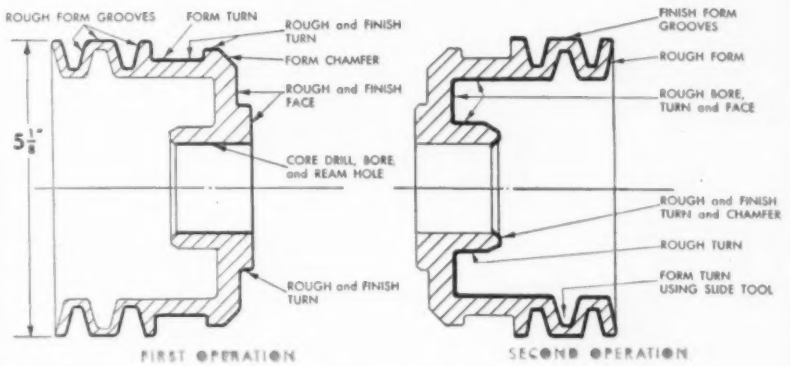

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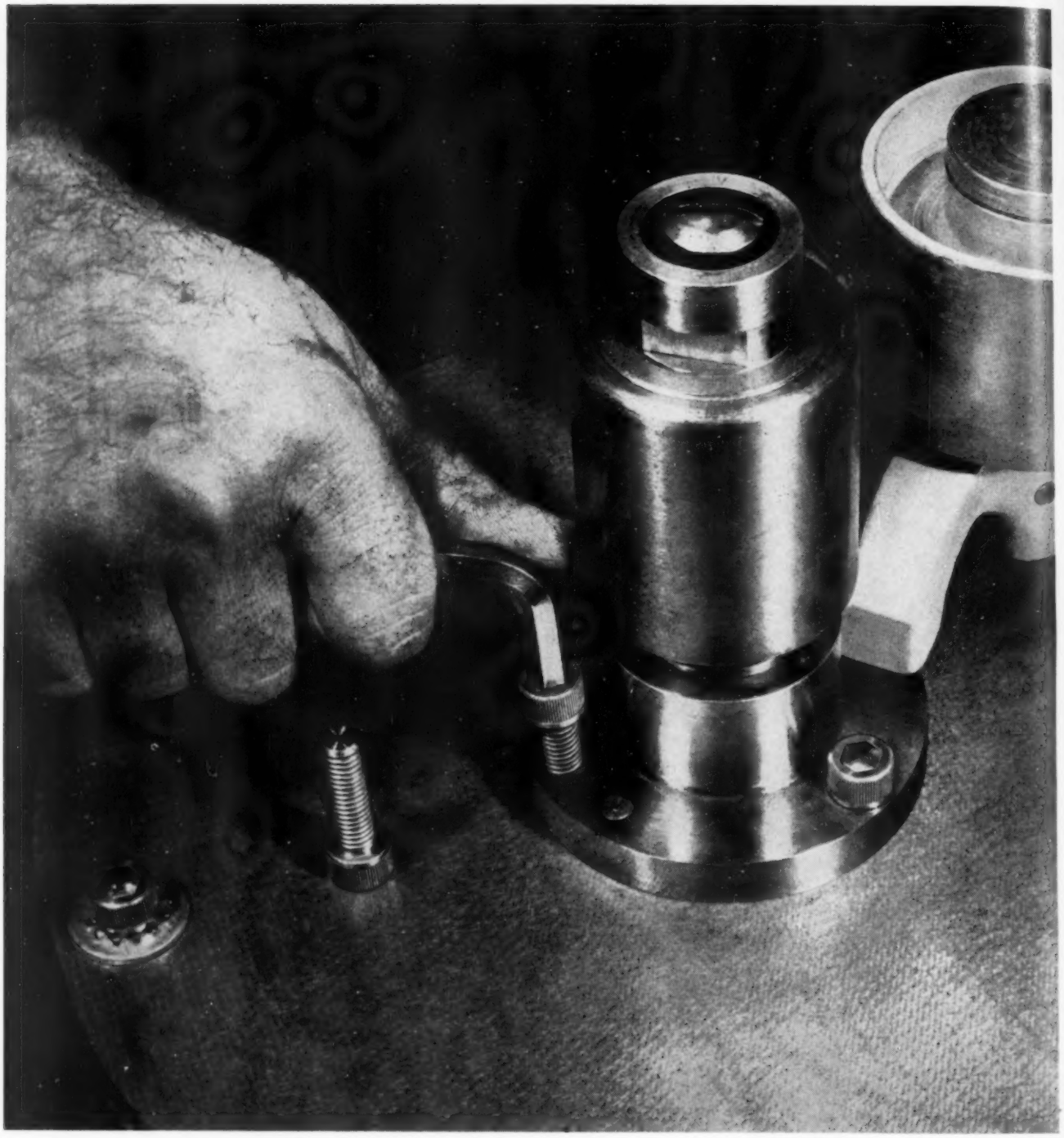

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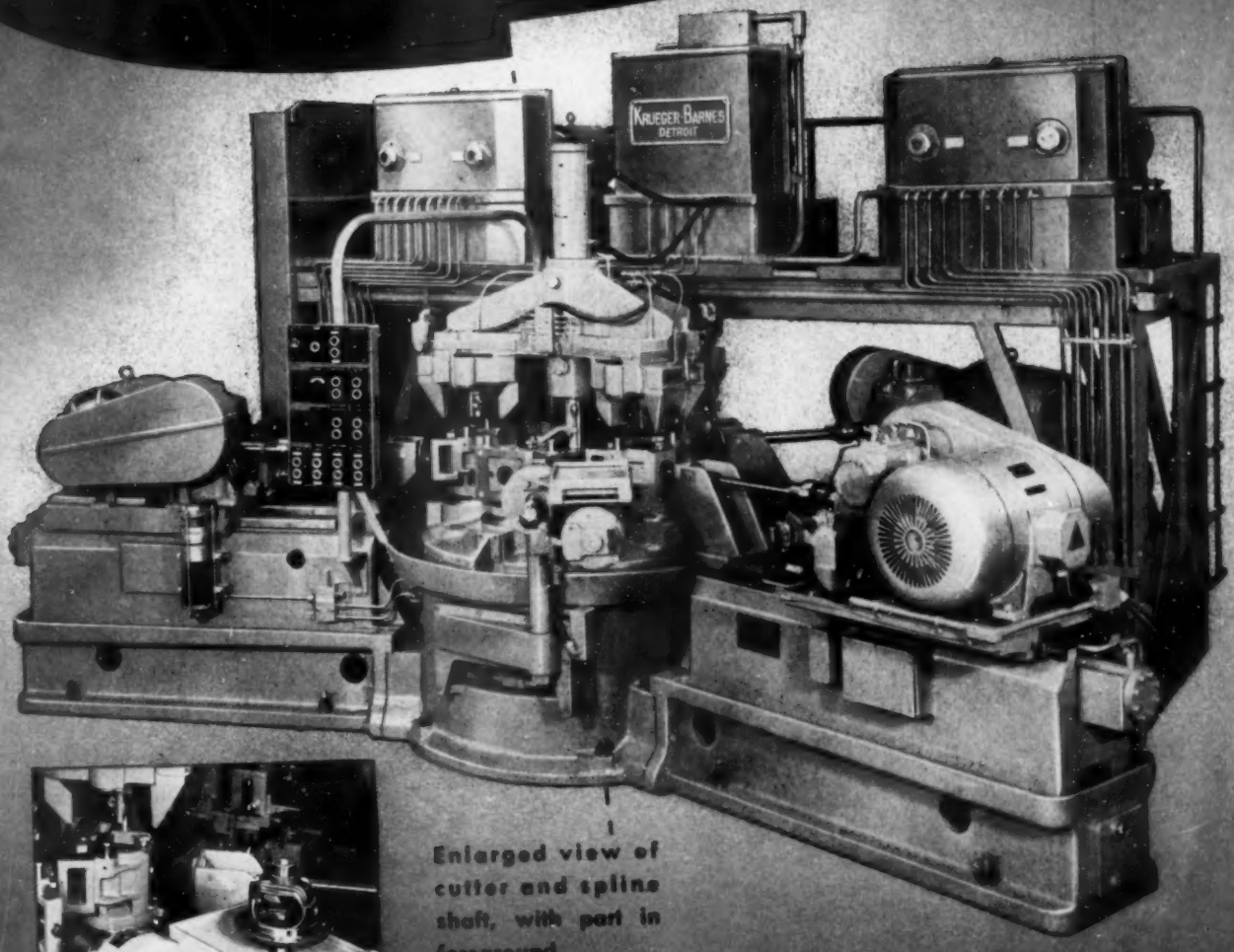

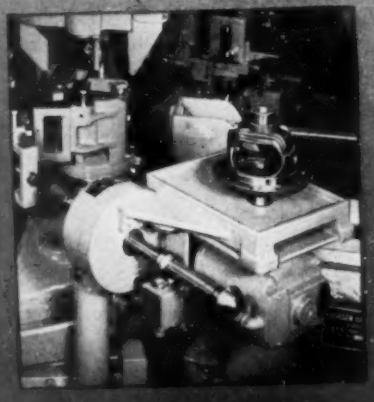

Enlarged view of cutter and spline shaft, with part in foreground.

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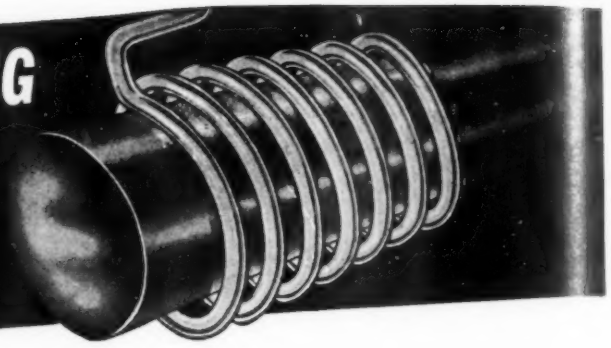

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Permits widest choice of silver or copper brazing alloys from lowest to highest melting points. Ideal for brazing carbide tips.

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Heat localized exactly where wanted at desired temperature. Ideal for gears, cams, bearing surfaces, cutting tools and other areas that are subject to wear.

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Speedily and neatly performs intricate soldering applications with or without the use of preformed rings.

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Ideal for annealing, stress-relieving, normalizing or preheating selected areas.

MELTING
Readily melts quantities of ferrous and non-ferrous metals in either graphite or ceramic crucibles.

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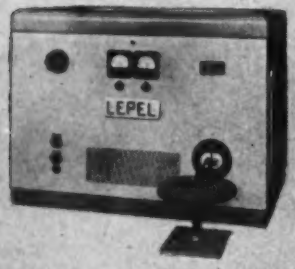
HIGH FREQUENCY *Induction* HEATING UNITS

The Lepel line of induction heating units represents the most advanced thought in the field of electronics as well as the most practical and efficient source of heat yet developed for industrial heating. With a background of half a century of electrical and metallurgical experience, the name Lepel has become the symbol for quality in induction heating equipment embodying the highest standards of engineering achievement, dependable low cost operation and safety.

If you are interested in the application of induction heating you are invited to send samples of the work with specifications of the operations to be performed. Our engineers will process these samples and return the completed job with full data and recommendations without any cost or obligation.



2½ KW INDUCTION HEATING UNIT

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LEPEL Electronic Tube GENERATORS
1 KW; 2½ KW; 5 KW; 10 KW; 20 KW; 30 KW; 50 KW; 75 KW; 100 KW.

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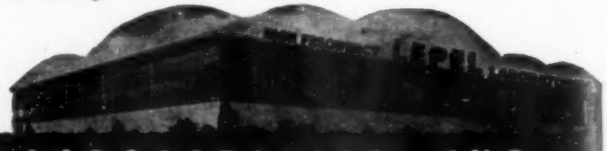

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NEW STYLE 46-D

For accurate reconditioning of all types of single-point boring, turning and facing tools; also dovetail and straight shank form tools. This grinder has a new in-built motor spindle designed for maximum rigidity. Wheels are mounted on the spindle shaft. Ball bearings are lifetime lubricated. Tool rest tables are at a comfortable height for operator convenience.

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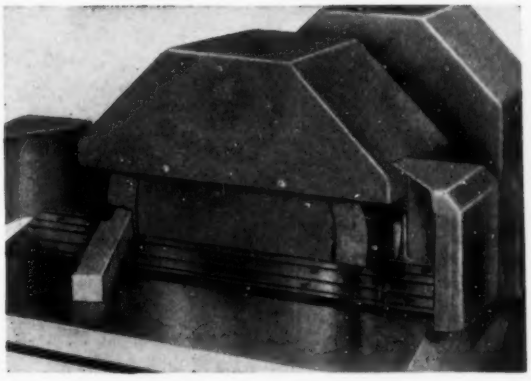
STYLES 46-D AND 49-A

NEW STYLE 49-A

A heavy-duty grinder that takes carbide, cast alloy and high-speed steel tools, medium and large size.

This new grinder has a new coolant system; is easier to clean and stays clean longer; troughs and coolant return lines are bigger, more accessible, and a settling tank is added.



LARGE TOOL REST TABLES

Illustrated is the tool rest table on the Style 49-A. It supports the biggest tools firmly. Adjustment is quick and easy to the required angular setting, and to compensate for wheel wear.

Wheel spindle is permanently lubricated.

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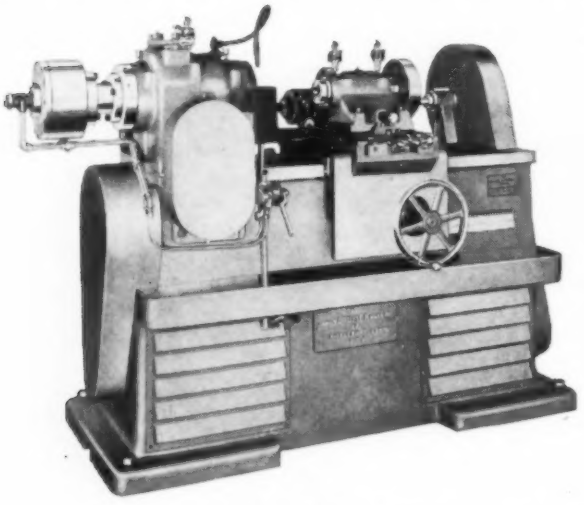

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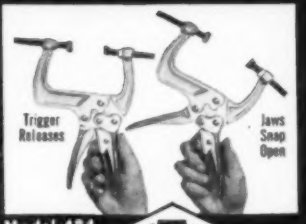

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Model 482

Model 486

Instant easy action enables operator to release clamp *with one hand!*

TRIGGER-RELEASE—Finger pressure on Trigger instantly throws jaws wide open, ready for next clamping action.

GREATER CLAMPING PRESSURES—Up to 1200 pounds may be exerted. Normal operating pressures of 300 to 500 pounds are easily obtained.

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Bath Reversible Thread and Reversible Cylindrical Plug Gages

- Bath Gage manufacture is based on quality
- Bath Gage engineering features experience
- Bath Gage personnel is highly skilled
- Bath Gage equipment is thoroughly modern
- Bath Gage production methods are progressive

Bath products have always been manufactured on an established policy of high quality. The basic desire to produce gages that are primarily an accurate standard of measure, requires experienced engineering, skilled craftsmen, modern equipment and progressive methods — plus a determination to build a reputation in the industry for gages that combine precision and long wear life.

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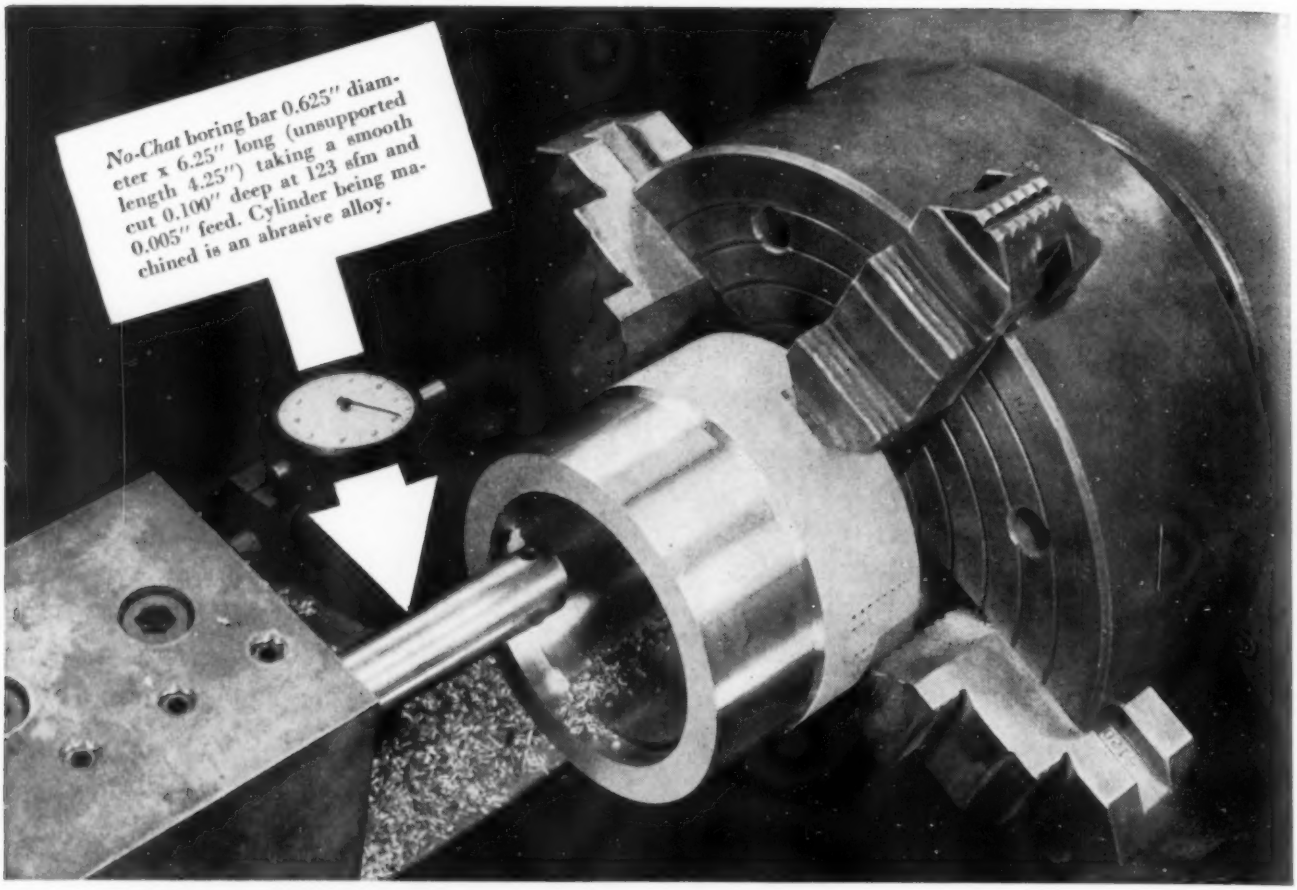
No-Chat boring bar 0.625" diameter x 6.25" long (unsupported length 4.25") taking a smooth cut 0.100" deep at 123 sfm and 0.005" feed. Cylinder being machined is an abrasive alloy.

Tools vibrate less . . . last longer . . . with Mallory No-Chat boring bars*

Tool chatter can now be reduced as much as 50% and machining costs minimized, by means of *No-Chat* tool shanks and boring bars. Made possible by Mallory metallurgical research, this development offers improvements in cutting tool performance never before possible. It utilizes a high density alloy which is far heavier, more rigid and a better heat conductor than steel . . . and superior structurally to other heavy materials.

FINER FINISH is possible even on heavy cuts. Finish grinding can often be eliminated.

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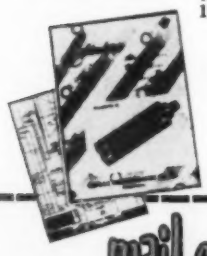

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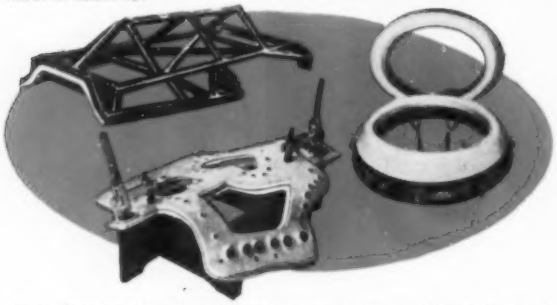

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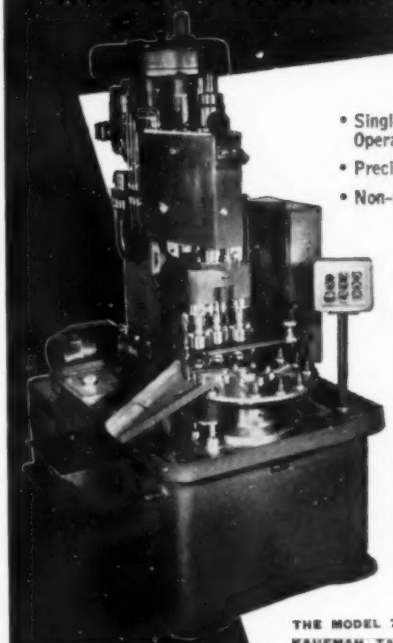

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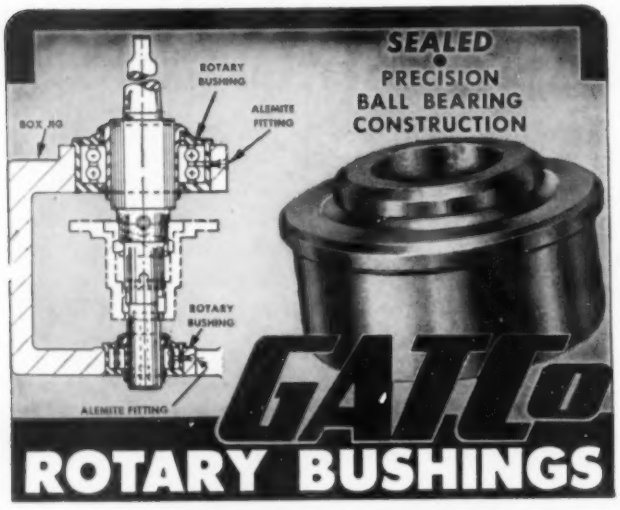

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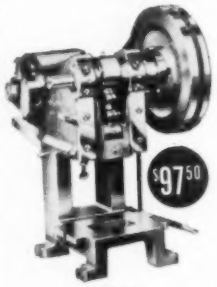

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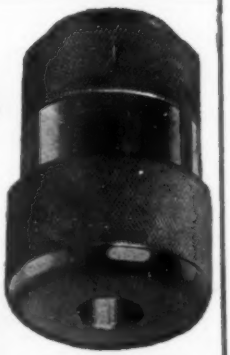

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FEATURES:

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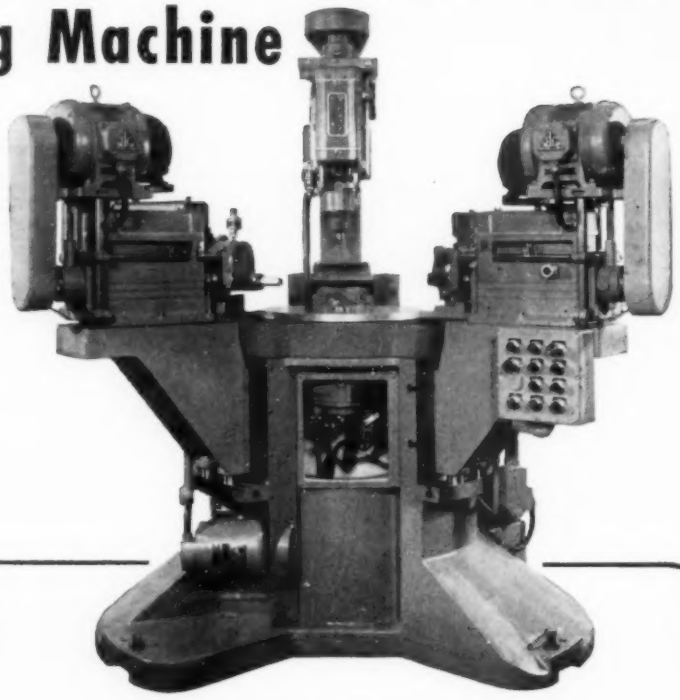

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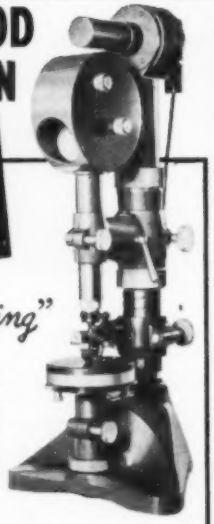

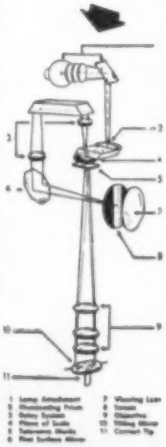

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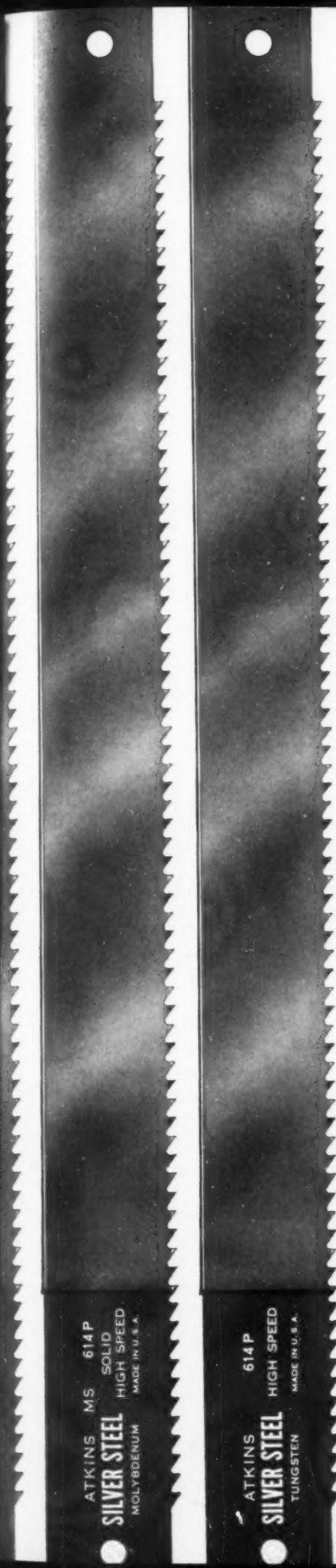

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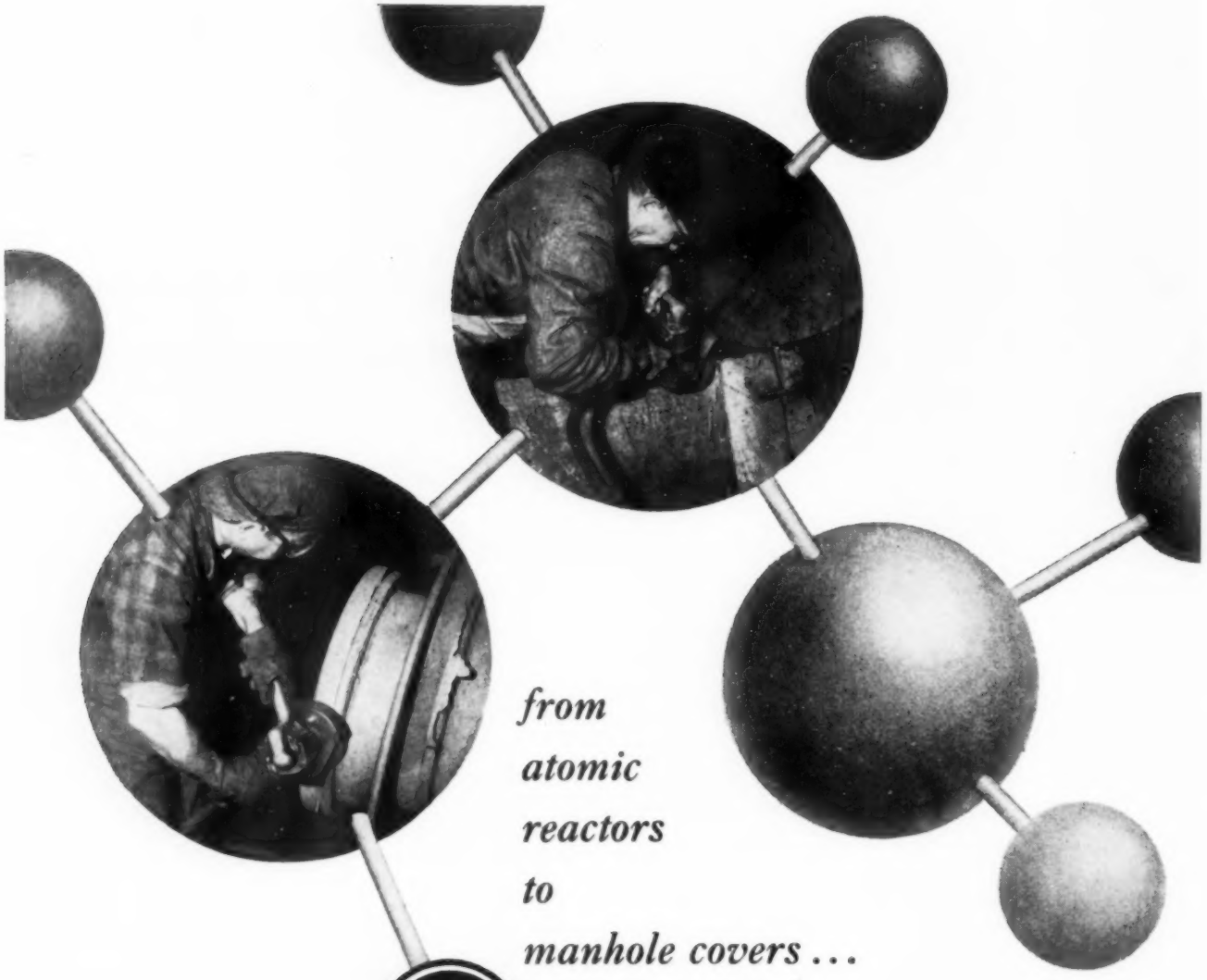

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7 pound CP grinder grinds them all!

Here's a grinder that can't be beat for handling ease and versatility. It's the 7 lb. air powered CP-3190 Vertical Grinder. Whatever the job . . . whether it's precision contour grinding for joining components of an atomic reactor or the heavy duty snagging of grey iron from manhole cover castings, the compact CP-3190 affords maximum removal of metal with the least amount of effort.

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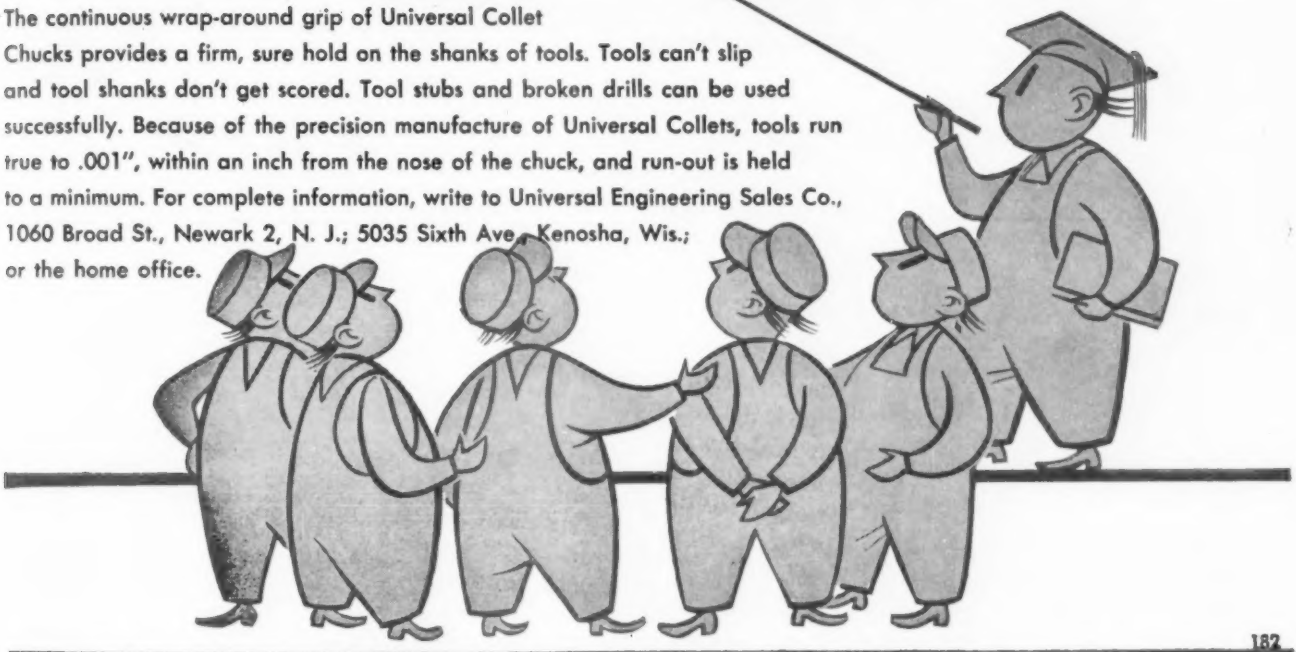

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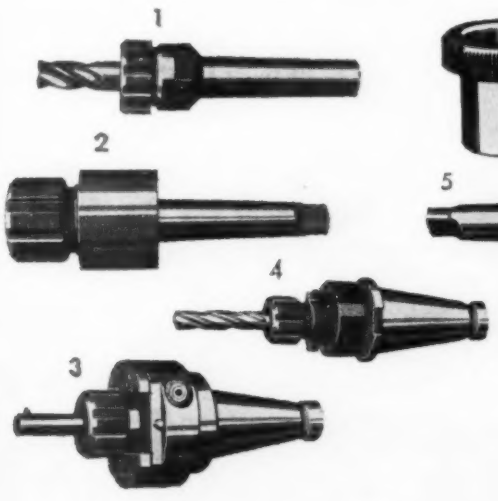

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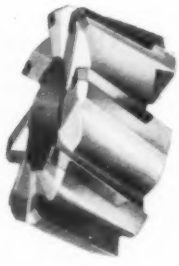

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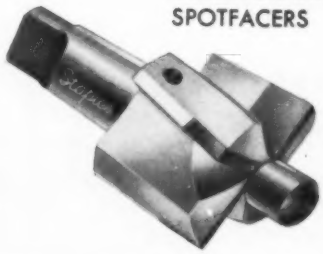

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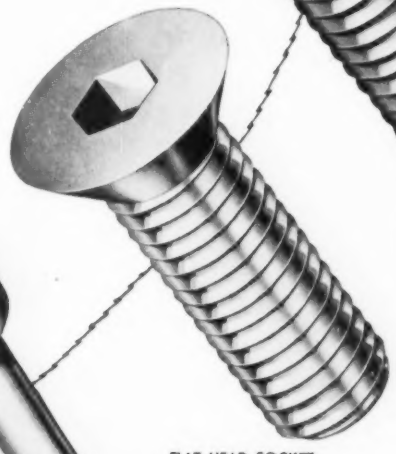
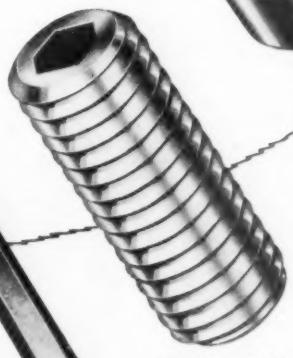


FLAT HEAD SOCKET CAP SCREWS

SHOULDER SCREWS



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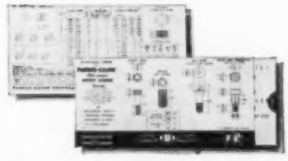

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Helps you plan assemblies. Pocket-size plastic slide chart gives essential dimensions of all types of P-K Socket Screws. Call your **P-K SOCKET SCREW DISTRIBUTOR**

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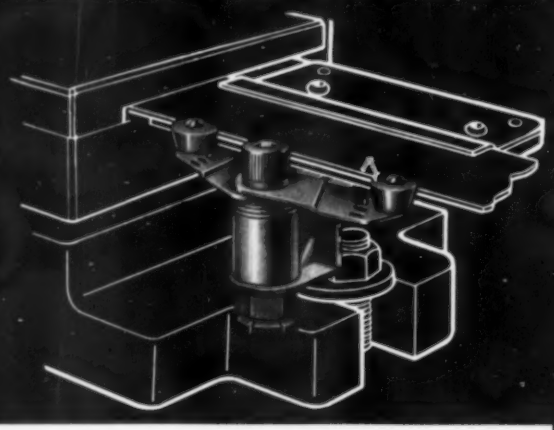

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READY MADE—QUICK TO INSTALL

Versatile...for use on dies or in any operation where coil or strip stock must be guided.

Low-cost...the cost is only a fraction of the shop expense necessary to tailormake a guide.

Rugged...constructed entirely of steel. Rollers, arms, collar and bracket are hardened. Adjustable, three-coil music wire spring.

Roller Guide, Large.....$4.50 each
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Guide Rail.....$3.50 box of five (all one size)
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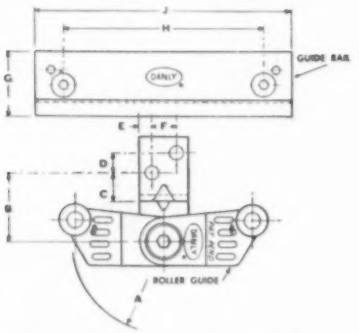

Roller Guide Dimensions, Inches

	Cat. No.	A	B	C	D	E	F
Roller Guide Large	9-70-6	2 3/64	1 13/32	3/8	1/4	5/16	7/16
Roller Guide Small	9-60-6	1 27/64	1 1/16	7/16	5/16	3/16	3/8

Danly Roller Stock Guides packed one to a box unassembled, furnished with light or heavy-duty spring for optional use plus all necessary mounting screws and mounting instructions.

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	9-8045-6	.045	1	3 1/8	4
	9-8080-6	.080	1	3 1/8	4
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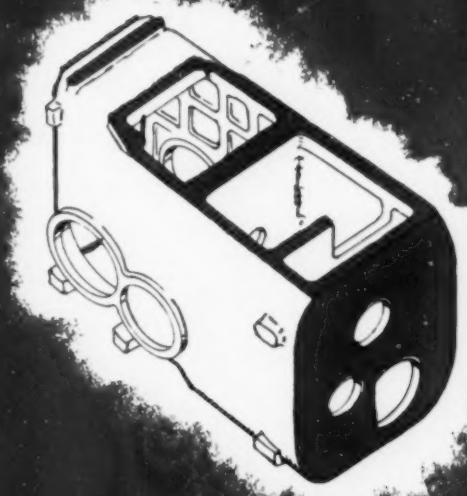
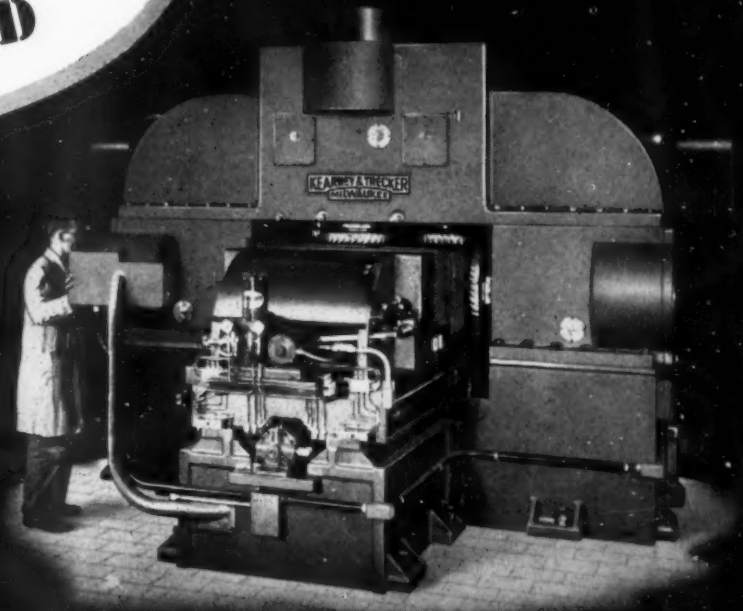
One of the nation's famous-name farm machinery manufacturers required a big, high-speed, precision production milling machine which would mill several surfaces on huge, 625-lb. transmission case castings in a single setup.



KEARNEY & TRECKER MILWAUKEE DESIGNED



Kearney & Trecker's proposal was accepted and the result was this 44-ton, Five-Spindle Triplex machine which mills top, front and rear surfaces of tractor transmission cases at a rate of 23 pieces per hour.

Two horizontal spindles are mounted in duplex fashion and three vertical spindles on the massive bridge type head. Horizontal spindles, driven by 40-hp motors, carry 22" dia. cutters with 44 blades. Powered by a 50-hp motor, two of the vertical spindles have 22" dia. cutters and the third spindle a 6" dia. cutter with 12 tungsten-carbide blades.

New production efficiency starts with Kearney & Trecker Milwaukee machine tools

Kearney & Trecker automatic production machines perform many operations to exacting accuracies and at lower cost. But most important to you — it's accomplished by combining standard design components with a minimum of special engineering. This means you get the production you want, the economies you need, from job-proven designs with minimum of capital investment.

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For more details on machine illustrated ask for Data Sheet No. 1062. Booklet "Doorway to a proven method for solution of big and small metalworking problems" is also yours for the asking.

Builders of Precision and Production Machine Tools Since 1898

LOW RAKE *means* . . .

STEELWELD
LOW RAKE ANGLE
HIGH RAKE ANGLE
SHORT SECTION UNDER PRESSURE DURING CUTTING
MORE BENDING WITH HIGH RAKE
LOW RAKE ANGLE
LONG SECTION UNDER PRESSURE DURING CUTTING
LESS BENDING WITH LOW RAKE

Built in all sizes for cutting thicknesses of 12 gauge to 1¼ inch and lengths up to 18 feet.

LESS

TWIST Excessive bending during cutting is the major cause of twist in pieces sheared. There is a direct relation between bending and the rake or shear angle of the upper knife. A high rake bends a piece MORE than a low rake because a SHORTER section of the stock is under pressure during cutting.

CAMBER Departure of the edges of a strip from a straight line is called camber. An important factor in causing camber is high rake which tends to rotate a sheet during cutting.

BOW Bow is deformation in a direction perpendicular to the surface of a strip. Here again experience shows that low rake gives the best results.

WHEN CUTTING WITH STEELWELD SHEARS

MORE is required of a shear than the power to cut, to achieve precision shearing. A great deal depends on how the cut is made if parts cut are going to fit accurately without additional work.

For this reason rake, or knife shear angle has been made very low on all Steelweld Shears. This of course requires more driving power and consequently a larger driving motor and heavier construction throughout than would be necessary with a higher rake. But it minimizes twist, camber and bow in pieces cut.

Because of low rake and also because of the ease with which knife clearance is adjusted to suit every plate thickness, cuts made on Steelweld shears are unusually smooth, straight and true.

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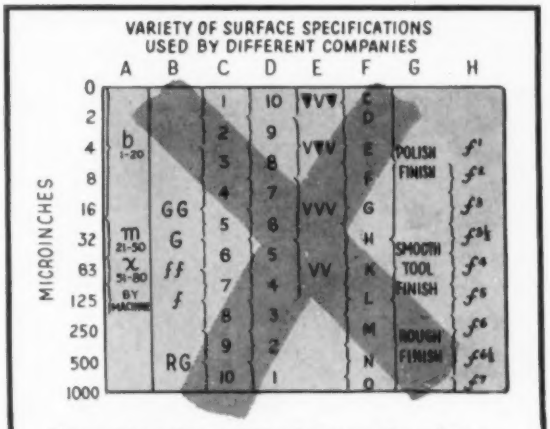
VARIETY OF SURFACE SPECIFICATIONS
USED BY DIFFERENT COMPANIES
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POLISH FINISH
SMOOTH TOOL FINISH
ROUGH FINISH

New Standard Eliminates Confusion in Surface Specifications

These individual methods of specifying surface finish can now be replaced by one uniform system with the new ASA and MIL-10 Standard. The Brush SURFINDICATOR is the only instrument completely meeting the new Standard.

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With only two items to handle — block and taper lock screw — it takes but a few seconds to insert a Davis block in its bar and start boring.

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Every boring job in your shop goes faster, more accurately and shows up far better on cost records when you standardize on Davis block tooling.

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Faster, more economical boring results from the complete interchangeability of the Davis block line. Four basic block styles can be used in any particular bar slot—and changing blocks is simpler and faster than any other method. Bring your boring operations up to date—write now for complete information on how Davis Interchangeable Block Tooling can save you time, money and rejects.

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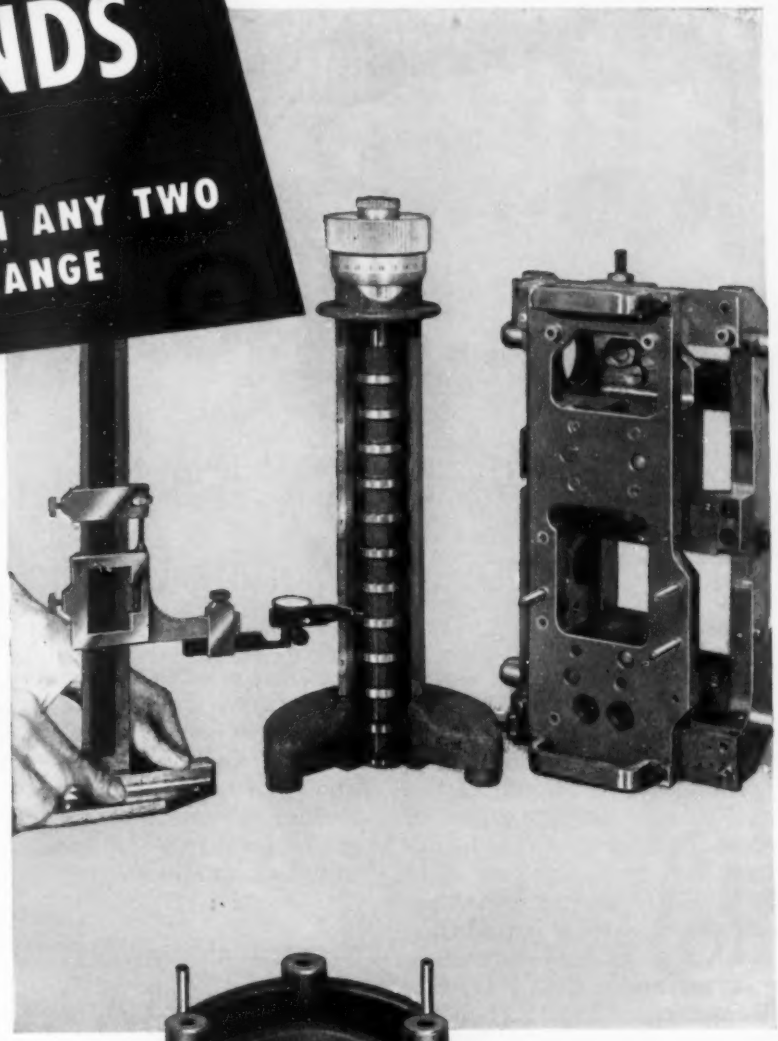
ACCURACY:

.00005" BETWEEN ANY TWO POINTS IN 12" RANGE



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SPEEDS ACCURATE INSPECTION from *MINUTES* to *SECONDS*

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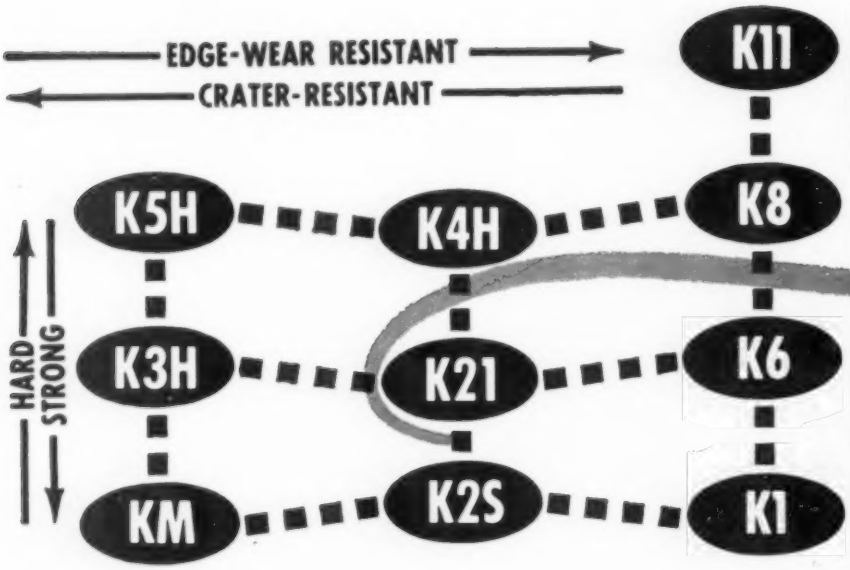
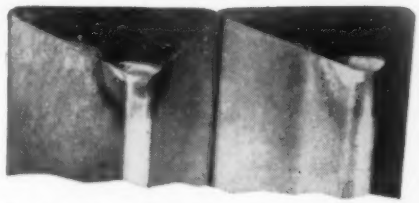


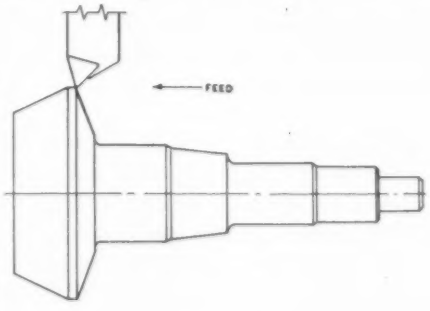
K21

Shows Exceptional Wear Resistance



Grade K21, on the left, shows less wear than competitive grade (at right) after turning 100 pieces.

Four competitive grades of cemented carbides were used in a recent comparative test machining SAE 4620 rear axle drive pinion forgings. (See drawing below.) Each grade was removed for examination of the cutting edge after turning 100 pieces. The competitive inserts showed sufficient wear to require indexing to a new cutting edge, while the Grade K21 insert (at left above) turned 200 additional pieces before it was indexed. This 3 to 1 ratio in tool life typifies the results being obtained on many types of machining jobs with this *new* Kennametal grade, including forgings, sandy castings, centrifugal castings, plate, weldments and highly abrasive silicon steels.



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Booths 410-411, Navy Pier, and
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Use Grade K21—the NEW Kennametal* General Purpose Steel-Cutting Grade

The Grade Selection Guide (above), which groups Kennametal grades according to strength, hardness, and wear characteristics, pinpoints the *new* K21 as a medium grade for general purpose steel-cutting applications. It is stronger than K5H, K4H, and K8. It has greater edge-wear resistance than K3H and KM, and more crater resistance than K11, K8, K6, and K1. Thus, K21 is for moderate, as well as heavy roughing of scaly, abrasive steel castings and forgings, and for interrupted cutting and milling operations requiring high resistance to edge wear, to cratering, and to shock. K21 shows exceptional performance on modern high-speed machines, and, due to its range, does an excellent job on older, slower-speed machines as well.

Because of this performance, K21 is rapidly becoming recognized as the leader of all general purpose steel-cutting grades. It's a premium grade at no extra cost. Ask your Kennametal Representative for performance facts; and for a copy of the Grade Selection Guide shown above . . . it's the most simple system of selecting the right grade for every job that has ever been developed.

Kennametal Engineers are ready to help you

Every Kennametal Representative is a tool engineer. He is trained to help you analyze tool wear—apply the right tool and grade to the job—establish proper lathe speeds and feeds—train machinists to get increased production at the lowest possible cost with Kennametal Tools. In addition to his own broad experience, he has available to him the backgrounds of 150 other Kennametal Tool Engineers. His office is listed in the classified telephone directory in principal cities. Call him, or write KENNAMETAL INC., Latrobe, Pa.

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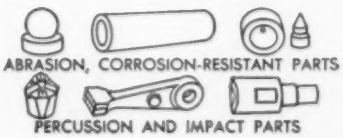

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Buhr ECONOMATION

Performs 23 operations every 18 seconds on automotive intake manifold!

This Buhr 5-way dial-type hydraulic-feed Special mills, drills, countersinks and individual-lead-screw taps 206 intake manifolds an hour gross.

The Machine is equipped with a Buhr 60"-diameter 6-position automatic index table, complete with shot bolt.

Chips are disposed automatically by means of a rotating chip conveyor.

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Buhr's precision manufacturing methods provide complete interchangeability of all parts and component assemblies.

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MULTIPLE-SPINDLE
PRODUCTION MACHINERY

See what Buhr Economation can do to reduce your production costs. A phone call, wire or letter will bring you a prompt consultation with one of our top sales executives.

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NOW! . . . fastest automatic in its range!

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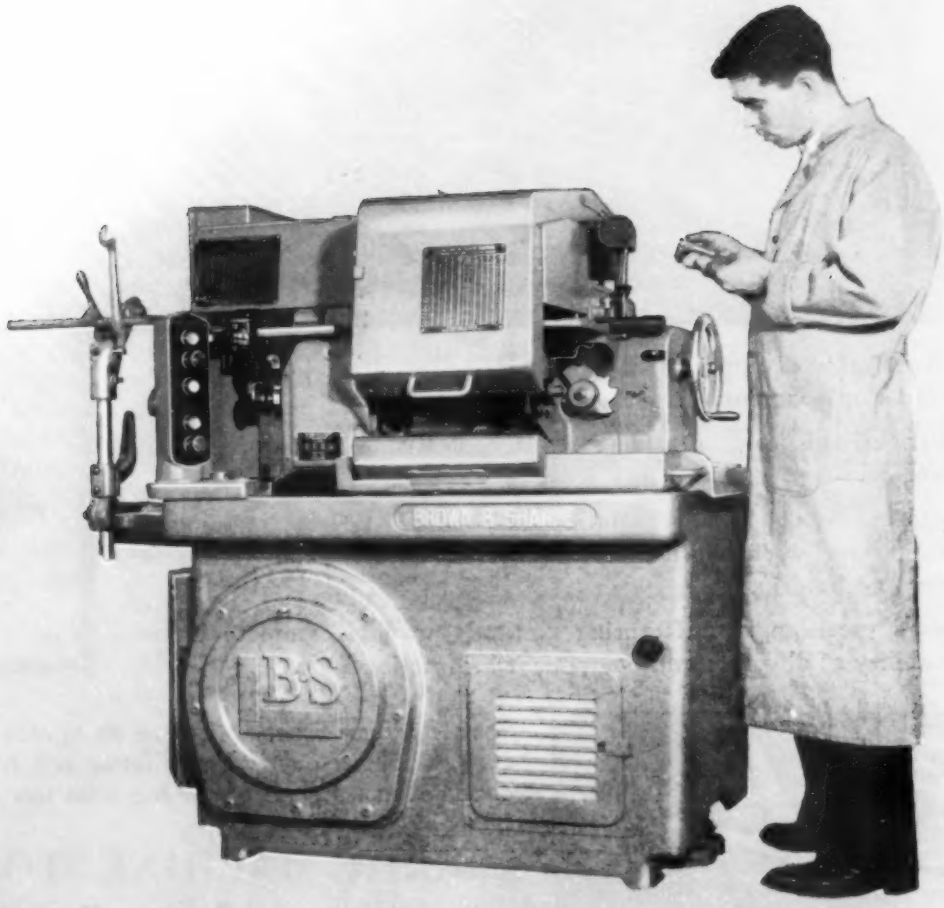
HIGHER



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Speed Range from 7200 to 34 rpm.
208 Spindle Speed Combinations for stock up to ½" diam.

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Turning Length to 1"; up to 1½" with extra equipment.

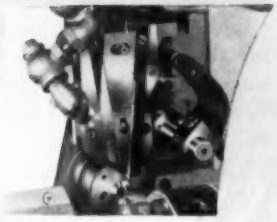
higher rigidity

Cross Slides and Detachable Ways of hardened, ground steel.

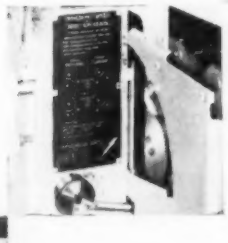
The most advanced automatic on the market for stock up to ½"! Push-button controlled. Actually increases output as much as 40% on many jobs — steps up others correspondingly. It's the new Brown & Sharpe No. 00 Automatic Screw Machine. Exclusive design features provide faster, easier set-ups . . . exceptional speed and turning capacity . . . outstanding accuracy . . .

OUTPUT

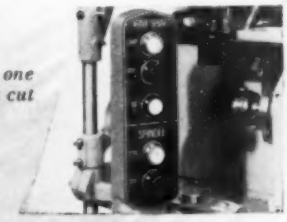
. . . permit carbide tooling where desirable. The most versatile, productive automatic in its range . . . assures highest cutting efficiency on all precision work. Write for full details. Brown & Sharpe Manufacturing Co., Providence 1, Rhode Island.



Improved Vertical Tool Slide, for extra tool position, is standard equipment.

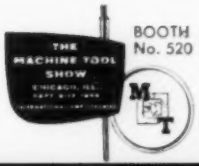


Driveshaft driven by 2 pick-off gears — no belts. Safety device prevents rotation in wrong direction.

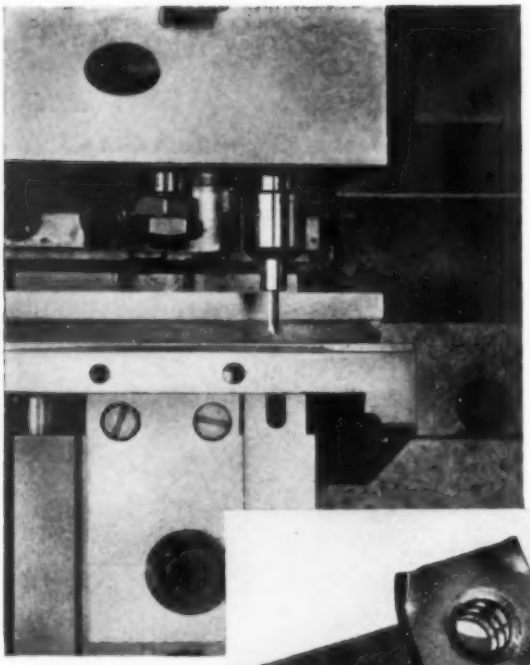


Push-button control — one of several features that cut set-up time materially.

Brown & Sharpe B·S

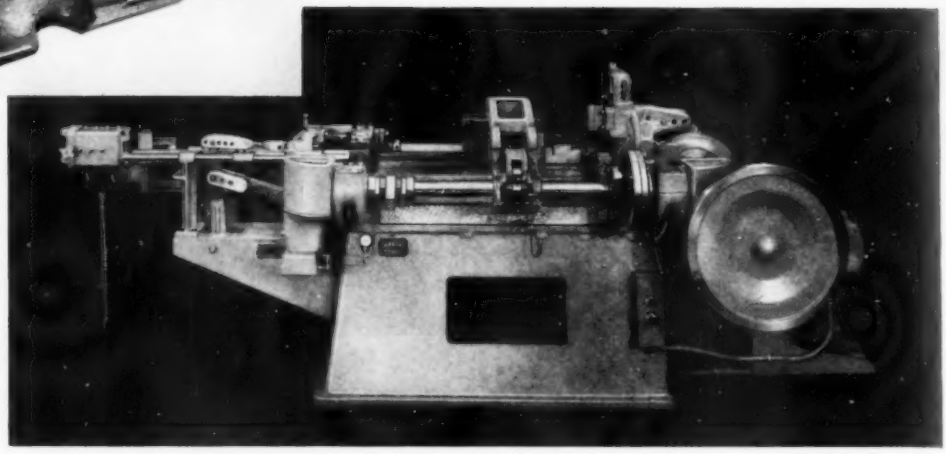


BOOTH
No. 520



Now! **In addition to trimming, piercing, swaging, embossing, blanking and forming . . . .**

TAPPING on the U. S. MULTI-SLIDE®



Top: Close-up top view looking down into tapping position on the U. S. Multi-Slide.

Above: Allen-Bradley Coil Terminal produced complete on No. 33 U. S. Multi-Slide, including tapping a 6-32 hole. Shown about three times actual size.

Right: Standard No. 33 U. S. Multi-Slide Machine which is used (with the addition of a tapping head) for the production of the part shown above.

See this equipment in operation at BOOTH 215, MACHINE TOOL SHOW, International Amphitheatre, Chicago, Ill., September 6-17, 1955.

The Allen-Bradley Company of Milwaukee, Wisconsin, manufacturers of quality motor controls, will install in their plant a No. 33 U. S. Multi-Slide Machine equipped with a tapping head to produce the Coil Terminal shown above *complete including the tapping of a 6-32 hole.* The incorporation of tapping in the U S. Multi-Slide eliminates the need for a secondary operation on this part.

The U. S. Multi-Slide is designed and built for the automatic production of stampings, and any or all of the following operations may be incorporated to produce complete parts at each stroke of the machine: trimming, piercing, swaging, embossing, blanking and forming. Now the possibility of including a tapping operation further increases the versatility of the Multi-Slide, and offers to the user increased potential for cost reduction by eliminating secondary operations and handlings.

Bulletin No. 15-T contains complete specifications. Write for a copy.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides — U. S. Multi-Millers

U S. Automatic Press Room Equipment — U S. Die Sets and Accessories

Production Doubled
Cost Cut 50%
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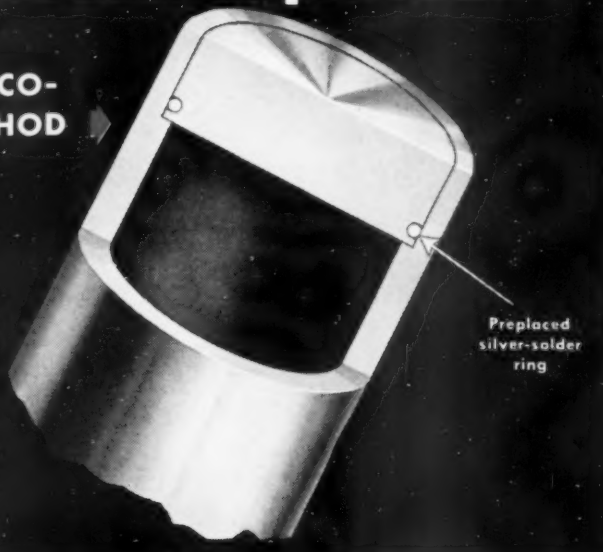

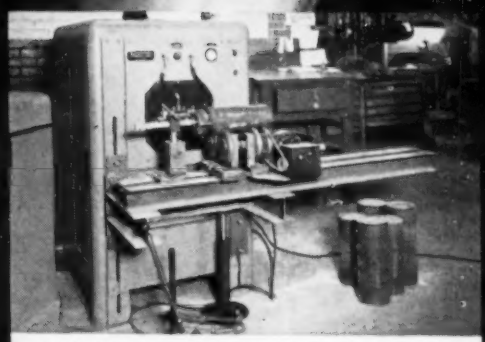

TOCCO heating station with inductor and fixture for silver brazing cylinder and cylinder cap assemblies.

with TOCCO* Induction Heating

The experience of The Commercial Shearing and Stamping Company, who use TOCCO for silver-brazing hydraulic cylinder assemblies, is typical of the benefits obtained by America's leading metal-working plants who use TOCCO Induction Heating for brazing, hardening, heat-treating, forging and melting operations.

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a. Heating time per piece cut from 15.3 minutes to 2 minutes on 5¼" I.D. cylinder.

b. Machining and cleaning operations, formerly required, are not needed after TOCCO brazing.

Lower Costs with TOCCO

a. Through a reduction in time required for each piece.

b. Through the elimination of scrap and reworks.

c. Because, since TOCCO is automatic, operator need not be trained or especially skilled.

Improved Product with TOCCO

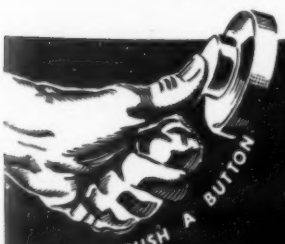
a. Because of better looks and sales appeal.

b. Because distortion is minimized.

c. Because of elimination of field failures due to severe stress pockets.

TOCCO Engineers — can probably find applications in your plant, too, where TOCCO Induction Heating can increase output, cut unit costs and improve your product. Such a survey costs you nothing—and may save you a great deal.

THE OHIO CRANKSHAFT COMPANY



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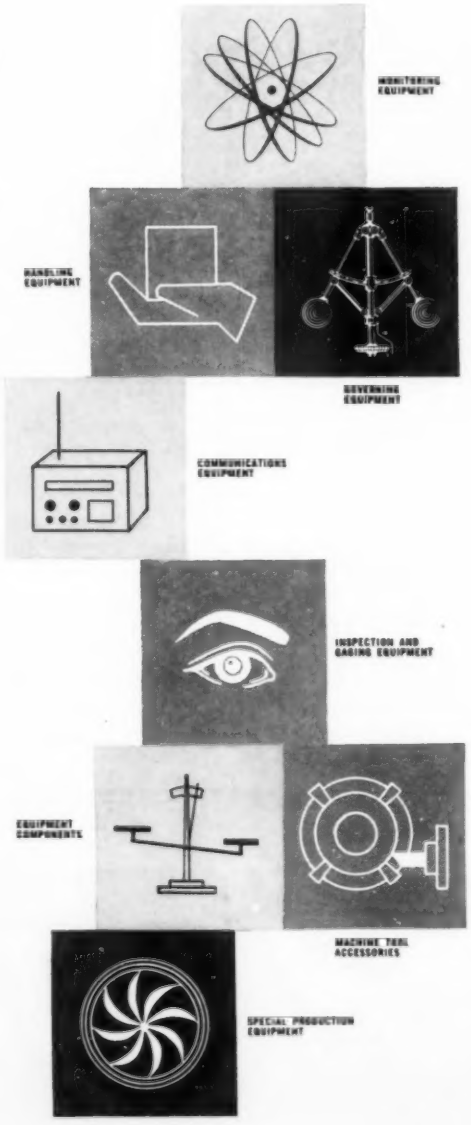
The Automation Exposition

See the devices, instruments, mechanisms and controls of automation you can apply right now!



An exposition that does something about AUTOMATION. Takes it out of the "blue sky" category. Shows you the practical things you can use to make production more automatic. Provides in one place, at one time, a comparison of the devices, instruments and controls to automate prime production equipment. Demonstrates how to integrate and control entire production lines to reduce costs and increase output.

The Production Engineering Show is a fitting companion to the great Machine Tool Show, held simultaneously in Chicago at the International Amphitheatre. See both shows. Your P.E.S. badge will admit you to the Machine Tool Show, too. And your M.T.S. badge will admit you to the Production Engineering Show. Write for tickets to:

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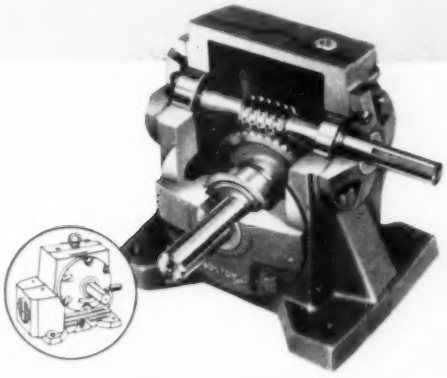

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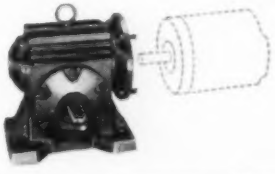

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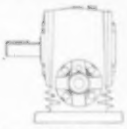
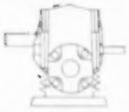


Horizontal Right Angle Drive Worm gear on top

Horizontal Right Angle Drive Worm gear under

Vertical Right Angle Drive

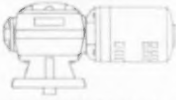


Horizontal Parallel Drive Double Reduction

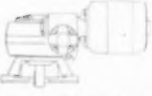
Vertical Right Angle Drive Double Reduction

Horizontal Right Angle Ratiomotor

Horizontal Parallel Ratiomotor Double Reduction



Vertical Right Angle Ratiomotor



Vertical Right Angle Ratiomotor Double Reduction

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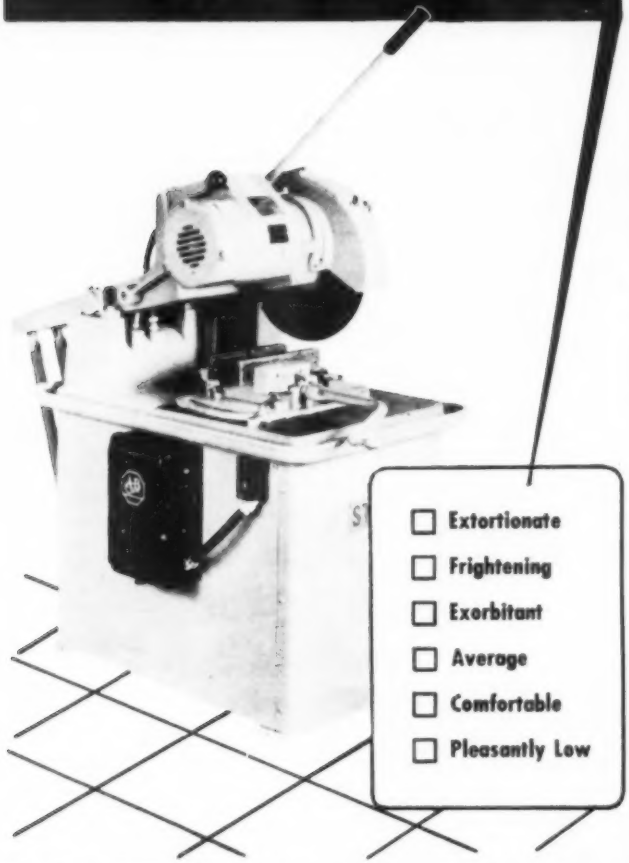

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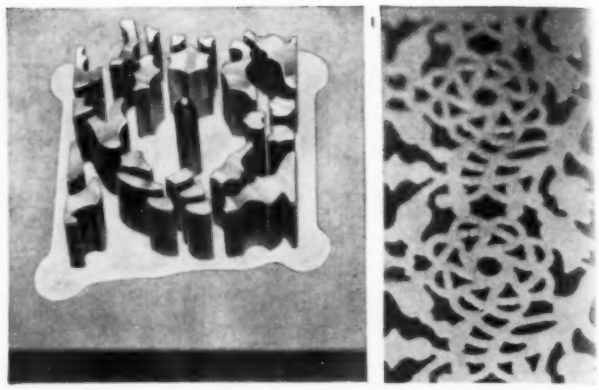

Photos courtesy Stebbins Tool & Die Co.

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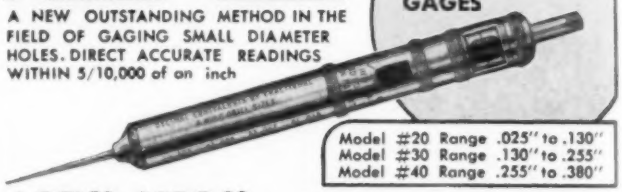

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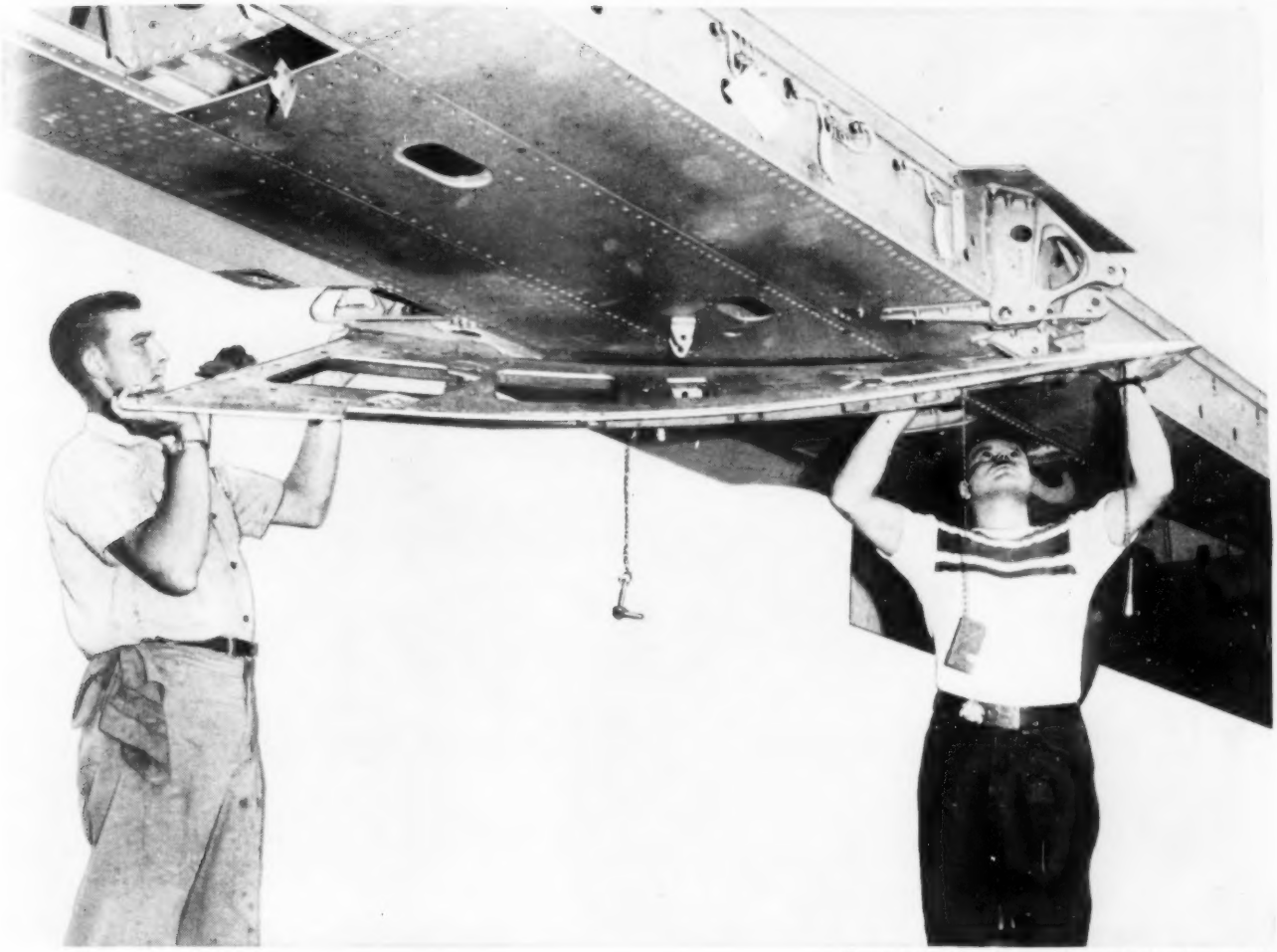

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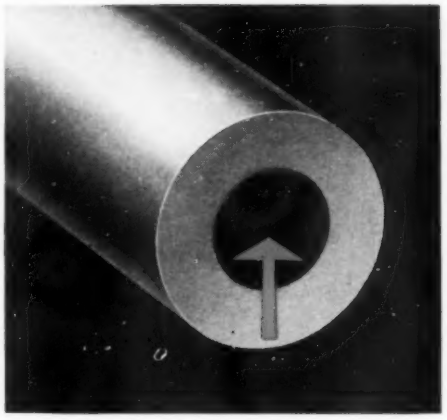

a hole here saves money

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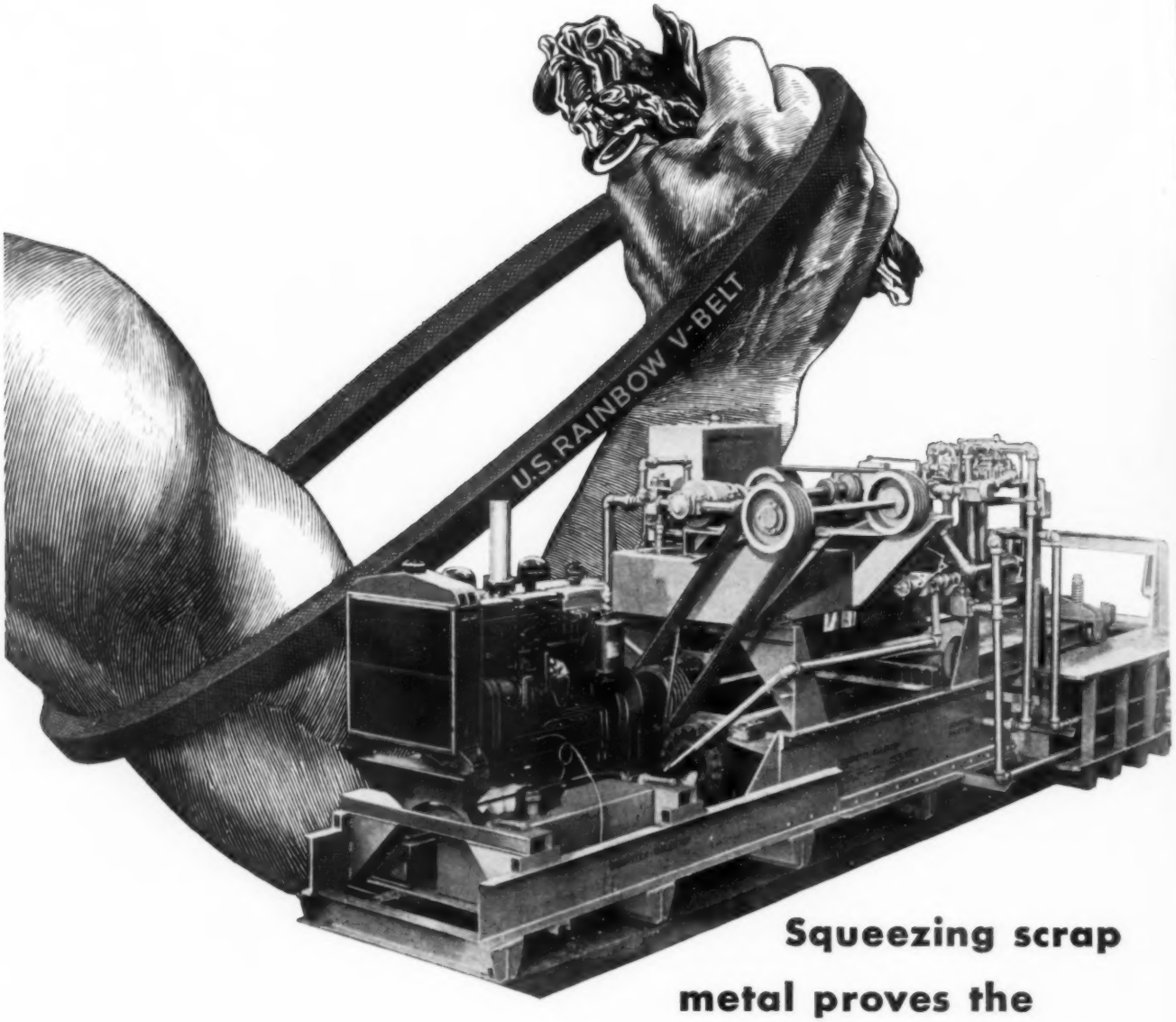

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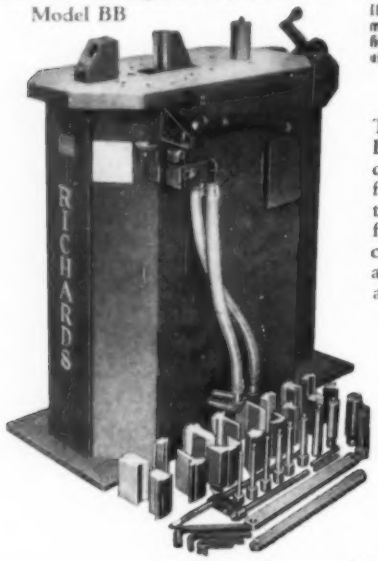
Produces Without Special Tooling—Saves Die Costs Saves on Expensive Presses

Model BB



Illustrated above are a few of the many forms that can be produced efficiently on the Multiform Bender, using the standard tooling.

The heavy duty Big Brother Bender is designed for fabricating bus bars, brackets, fixtures, etc., without special tooling. Air controlled with finger tip response. Comes complete with dies, mandrels and wrenches—punching and blanking dies extra.

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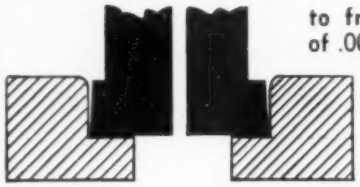
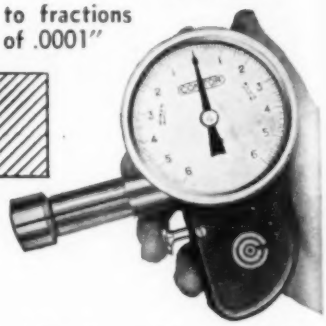


to fractions of .0001"



Unique 2-point gaging at tip measures to very bottom of shoulder or hole.

COMTORPLUG with interchangeable expanding plugs to gage simple or special bores from 1/8" to 8" dia.

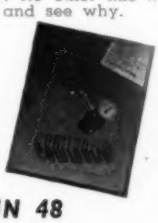
UNIQUE ADVANTAGES

- Positive gaging accuracy to fraction of .0001" regardless of who operates it.
- Indicates actual size, a fixed—not passing—reading.
- Positive 2-point gaging—automatic centering.
- Shallow holes, deep holes, inside splines, open-end holes gaged easily.
- Detects ovality, back or front taper, bell mouth, barrel shape.
- Reaches to bottom of blind holes.
- Gages work while still held in chuck.
- A shop tool for all-day every day use.
- Portable—no wires, hoses or stands.

Investigate the gage used by the thousands in jet engine, guided missile, farm machinery, automotive transmission, household appliance and other volume-precision plants. IT MAKES PRECISION GAGING EASY . . . at machine . . . at inspection bench . . . for selective assembly. No other like it—investigate and see why.

COMTOR COMPANY

69 Farwell Street
Waltham 54,
Massachusetts



GET THE FACTS—REQUEST BULLETIN 48

USE READER SERVICE CARD; INDICATE A-7-244-3

Over 85% of the torque wrenches used in industry are

STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel

- Permanently Accurate
- Practically Indestructible
- Faster—Easier to use
- Automatic Release
- All Capacities

in inch grams
...inch ounces
...inch pounds
...foot pounds

Every manufacturer, design and production man should have this valuable data. Sent upon request.

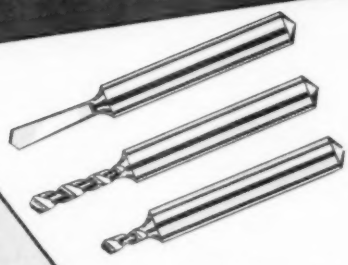
P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

USE READER SERVICE CARD; INDICATE A-7-244-2

HIGH SPEED MICRO-DRILLS

STARTING FROM .0016"

"IN STOCK"!



Precision micro-drills for small holes. Sizes from .04 mm (.0016") to 1.0 mm (.040") in increments of .01 mm (.0004"). These precision drills are available in two styles, flat pivot drills or spiral fluted drills. Center drills for micro-drilling also available from stock. They are all made with concentric oversize shanks. Because of their extreme rigidity they are especially useful in all types of drilling equipment.

Send for Bulletin "P" listing sizes and prices of stock drill sizes and micro-drilling equipment.

LEVIN®

Sphinx brand micro drills used throughout the world for many years for all fine watch and instrument work.

LOUIS LEVIN & SON, INC.
3610 South Broadway · Los Angeles 7, Calif.

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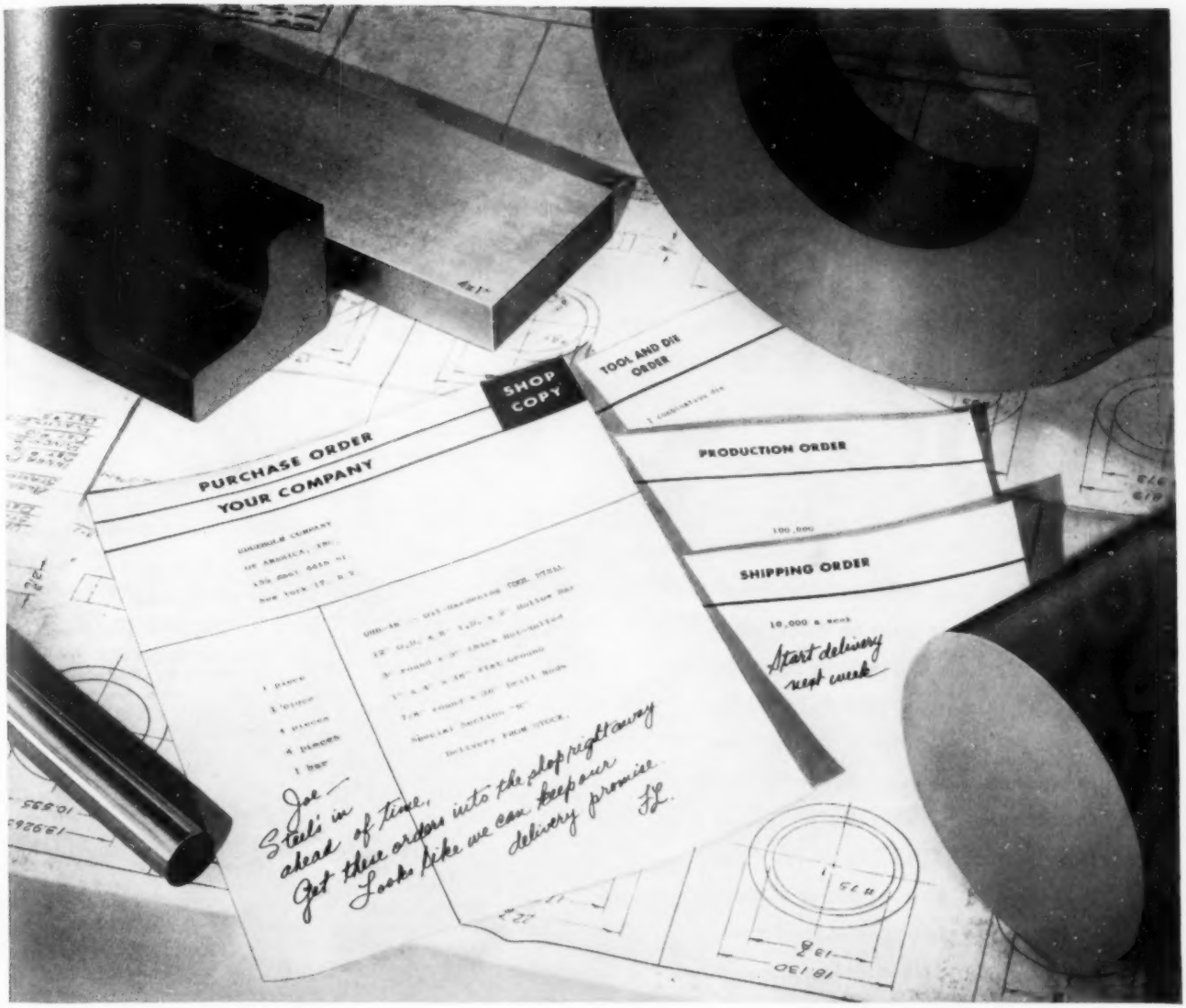

SHOP COPY
PURCHASE ORDER
YOUR COMPANY
TOOL AND DIE ORDER
PRODUCTION ORDER
SHIPPING ORDER
Start delivery next week
Joe—
Steels in ahead of time. Get these orders into the shop right away. Looks like we can keep our delivery promise.
FJ.

GET TOOL STEEL FAST—FROM UDDEHOLM

Before anything can be done on a metal-working job, the tool steel must be on hand. No die or tool can be made, no production started, and no orders delivered without it.

Furthermore, the need for tool steel is usually urgent—sometimes you need it "yesterday". Therefore, place your order with a source that has an extremely wide variety of grades, shapes, sizes, and finishes in stock—Uddeholm.

For instance, UHB-46 oil-hardening tool steel is stocked in all these forms: drill rods, flat ground stock, hot-rolled bars, special sections, and hollow bars.

Warehouses in New York, Cleveland, and Los Angeles.

WANT A STOCK LIST OF UDDEHOLM TOOL STEELS?

UDDEHOLM, 155 East 44th St., New York 17, N. Y.
Please send me ..... tool steel stock lists.

NAME_____

TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

UHB

UDDEHOLM COMPANY OF AMERICA, INC.

Tool and Die Steels
Specialty Strip Steels

New York: 155 East 44th Street, MUrray Hill 7-4575
Cleveland: 3756 Carnegie Avenue, HEnderson 1-7440
Los Angeles: 5037 Telegraph Road, ANgelus 2-5121

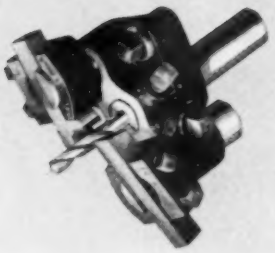
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-245

your most economical move

RIGHT R and L LEFT TOOLS

Realizing that a Screw Machine or Turret Lathe is only as good as the tools used on it, leading manufacturers* supply R and L TOOLS as original equipment with their machines. Get the most from *your* machinery . . . change to R and L TOOLS now! They'll pay for themselves *and the replaced tools* in no time through reduced set-up time and greater precision.

*List of manufacturers supplied on request.

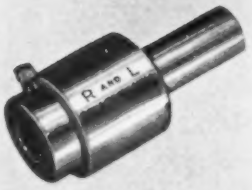


R and L TURNING TOOL . . .

replaces an assortment of 14 different tools costing more than five times as much as this ingenious tool . . . It changes from right to left turning, (or vice versa), in 10 seconds.

R and L TAP AND DIE HOLDERS . . .

feature a new release mechanism, (exclusive with R and L), which makes right or left threading possible.

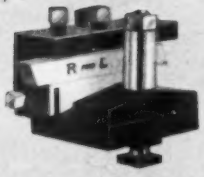


R and L KNURLING TOOL . . .

Half the weight . . . twice as efficient as other knurling tools . . . One hex wrench makes all adjustments, thereby cutting set-up time to a minimum.

R and L UNIVERSAL TOOL POST . . .

For use with square or flat tools, it can also be used for holding skiving tools, completely adjustable for use on front or back of cross-slide.



Write for new catalog

R and L TOOLS
1825 BRISTOL ST.
PHILADELPHIA 40, PA.

R and L RECESSING TOOL . . .

Newly designed . . . adjustable to operate on both internal and outside diameters, with spindle running right or left. It can be adjusted to handle any diameter within capacity of the machine.

CLIP AND MAIL THIS COUPON TODAY

☐ Please send me your new catalog
☐ Please arrange for no-obligation demonstration of R and L TOOLS

NAME .....

COMPANY .....

ADDRESS .....

T.-7

RIGHT R and L LEFT TOOLS
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO FURNISHED FOR ACORN DIES) • UNIVERSAL TOOL POST • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL

Taft-Peirce *Electrolized* Gages

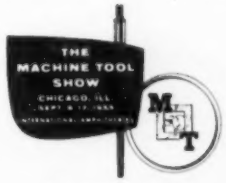
Last from 2 to 10 times longer

Costing only slightly more than ordinary hardened steel gages, Taft-Peirce Electrolized Gages provide many times longer gage life.

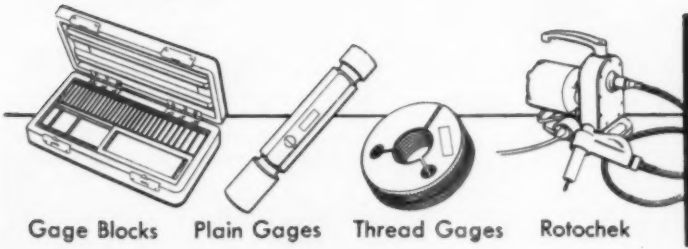
An even film of hard, non-magnetic alloy — only .000025″ thick — on all gaging surfaces provides exceptional wear-resistance.

Extremely smooth, this film has a very low co-efficient of friction, with high resistance to corrosion. Extremely tough, it won't chip, peel, or spall.

Electrolizing can be applied to standard or special fixed gages and to CompAIRator Air Gage members. Accuracy is held to the same high standards found in all Taft-Peirce gages. For more details on the complete line of Taft-Peirce Fixed Gages, write for Handbook.



See them in action at the Show — Booth 811



Gage Blocks Plain Gages Thread Gages Rotochek

T-P means Top Precision

T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, R. I.

Get More Tool and Cutter Grinding Capacity at Lower Cost with...

the NEW STERLING Model "RK-2"

All types of cutting tools from single point lathe tools to 22" diameter saws can be ground quickly and accurately on this completely NEW Tool & Cutter Grinder.

Eliminating heavy, expensive anti-friction tables provides greater stability, better accuracy and increased capacity at LOWER COST.

The compact design puts all controls in easy reach of the operator—set-ups take less time . . . the floating spindle moves so easily that operator fatigue is cut to a minimum. Standard equipment includes centers with 11" swing, and 14" between centers.

You get more capacity for grinding tools and cutters at about ½ the cost of a Universal Tool & Cutter Grinder with the NEW Sterling Model "RK-2".

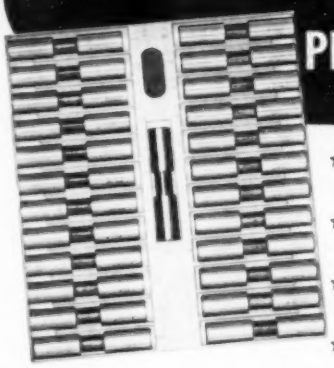
Write TODAY for illustrated bulletin RK-2.

McDONOUGH MFG. CO.

1517 Galloway • Eau Claire, Wisc.

USE READER SERVICE CARD; INDICATE A-7-248-1

CLOSER TOLERANCES with DELTRONIC TENTH PLUG GAUGES



★ Size variation by ten thousandths

★ Set of 25 costs approximately same as Go and No-Go gauge.

★ Available in increments of 1/64" from 1/8" to 1"

★ Hardness is Rockwell C62/C64

This new system of precision gauging provides one gauge of nominal size plus 12 gauges of increasingly larger sizes in .0001" increments and 12 gauges of decreasingly smaller sizes in increments of .0001". Each gauge is identified. It is the same size on both ends to double the life in usage.

For further information write Dept. D12.

DELTRONIC CORPORATION

1507 RIVERSIDE DRIVE • LOS ANGELES 31, CALIF.

USE READER SERVICE CARD; INDICATE A-7-248-3

Rapid SET-UP METHOD

In making set-ups for tapping and reaming jobs Ziegler Tool Holders will enable you to make a worthwhile time saving. Here's the reason why!

Instead of having to take the time to make an absolutely perfect set-up, as with ordinary tool holders, just align the work within 1/32" of center on the radius (1/16" on the diameter) and the Ziegler Holder will automatically compensate for the difference.

This rapid set-up method is fast becoming standard practice. It will pay you to try it out. PROMPT DELIVERY.

W. M. ZIEGLER TOOL COMPANY

13574 AUBURN DETROIT 23, MICH.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

USE READER SERVICE CARD; INDICATE A-7-248-2

The

Complete LOVEJOY LINE of Modern Metal Cutting Tools

The Lovejoy line of inserted-tooth type cutting tools has never been more complete — or offered so many features. Every tool has been designed to give maximum production with a minimum of down time for sharpening. Lovejoy tools feature the *exclusive* "Positive-Locking" device that assures rigidity even during heavy intermittent cuts — making them rugged as solid tools. Their housings — of husky forged steel — are designed for longest life.

Lovejoy H. S. S., Carbide and Cast Alloy Blades are interchangeable in the same housing and are stocked for immediate shipment.

For standard or special cutters, call on Lovejoy — suppliers to the world's leading manufacturers for over 35 years. Write today for Catalog No. 28 which describes the full line of Lovejoy tools.

Available free on request: 3 new catalogs — on *Arbors, Face Mills, Side Mills.* Also free, the Lovejoy *Speed and Feed Calculator.* Write today!

131 MAIN ST., SPRINGFIELD, VERMONT

LOVEJOY TOOL COMPANY, INC.

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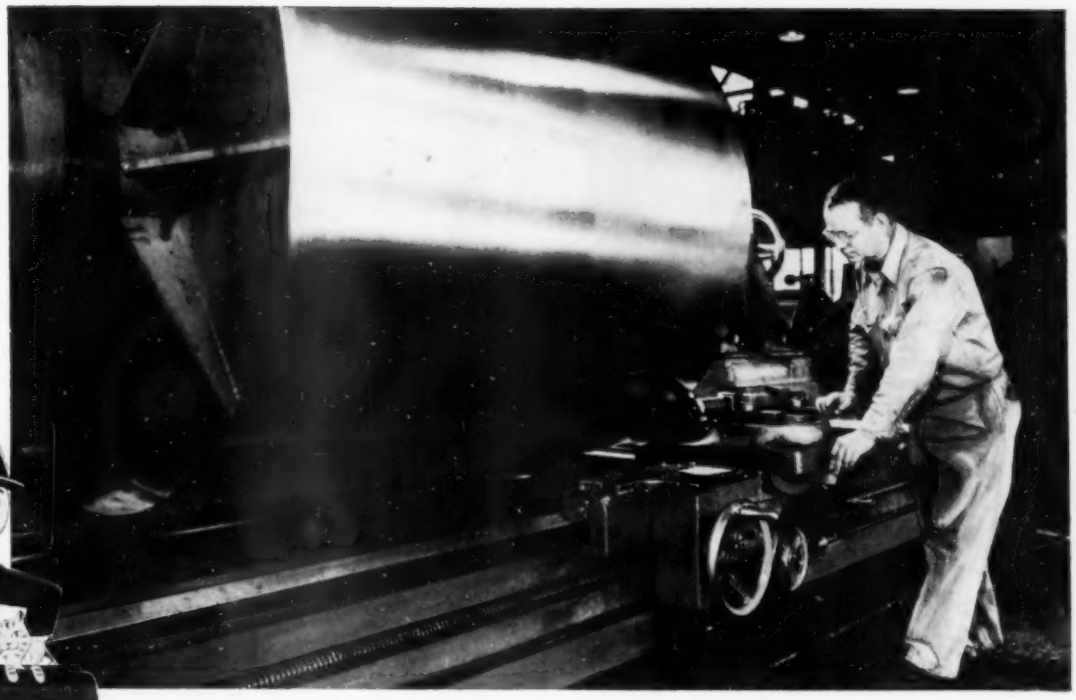


Photo, courtesy Commercial Machining Company, Conway, Pa. Turning 60" dia. stainless steel looping line roll.

Mr. Tooley Says:

"There's more than one way to skin a cat"

CIRCLE "C"

SUPER HIGH SPEED STEEL

- Operating speeds 25%—50% faster than ordinary high speed steels
- Longer tool life
- Cuts costs by increasing production
- Particularly suitable for cutting tough alloy and stainless steels

FIRTHITE

STANDARD TIPS, TOOLS, INSERTS AND HOLDERS

- Highest metal removal rate
- Uniform, dependable Firthite quality and performance
- Large stocks of standard tools and tips for immediate delivery
- Mechanically-held and brazed designs

Yes, in the field of tooling, alternative cutting materials make it possible to utilize the same production equipment for a variety of applications. In typical turning operations either Firth Sterling High Speed Steel or Firthite Sintered Carbide cutting tools may be selected . . . depending upon the characteristics of the metal and the production requirements of the job.

Firth Sterling, manufacturers of complete shop tooling needs, occupies the unique position of providing *both* steels and carbides to "skin the cat" of production in the most economical and effective ways. Thus, from *one* dependable source of supply you are assured of (1) completely unbiased tooling recommendations and, (2) the selection of the exactly right carbide or steel or *both* to provide maximum production!

Both Firth Sterling's famous CIRCLE "C" Super High Speed Steel and FIRTHITE Sintered Carbide cutting tools and tips are used alternatively for most metal removal operations. Write now for literature and unbiased recommendations for your specific needs.

R-305

Firth Sterling

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

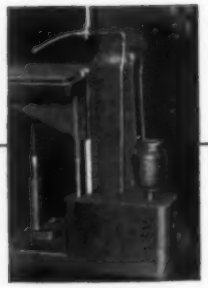
MILLS: McKEESPORT, TRAFFORD, DETROIT, HOUSTON

OFFICES AND WAREHOUSES*: BIRMINGHAM CHICAGO* CLEVELAND DAYTON DETROIT* HARTFORD* HOUSTON LOS ANGELES* NEW YORK PHILADELPHIA PITTSBURGH WASHINGTON WESTFIELD, N.J.

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets
Zirconium

CALL YOUR FIRTH STERLING DISTRICT OFFICE OR DISTRIBUTOR. ASK MR. TOOLEY.



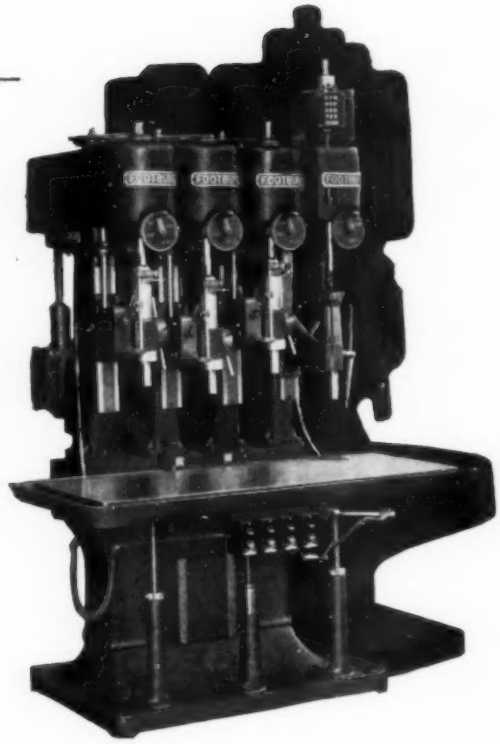
FOOTBURT

Sensitive

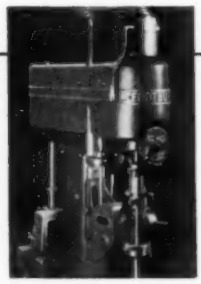
DRILLING MACHINES

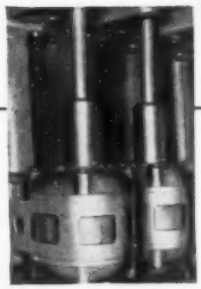
A FULL RANGE
DRILLING MACHINE
ENGINEERED FOR
PRODUCTION

■ Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitives are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counterboring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.



■ No. 2 Machine with Back Gear • 12" Overhang • 5/8" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.





THE FOOTE-BURT COMPANY
Cleveland 8, Ohio
Detroit Office: General Motors Building

☆engineered for production

FOOTBURT

MACHINE TOOLS

Miller HIGH PRESSURE HYDRAULIC CYLINDERS

Provide Desired Thrusts Up to 160 Tons Plus!

HARD CHROME PLATED PISTON RODS
Prevent Scratch-Damage, Nicks and Rust

SOLID STEEL HEADS, CAPS and MOUNTINGS
Eliminate Breakage

DIRT WIPER SEALS
Protect Rods, Seals, Bushings

Standard Leather Cup Seal Assembly Shown Is Interchangeable With Miller Standard Piston Ring Piston Assembly

IMMEDIATE DELIVERY ON LARGE SELECTION

Most complete quality line ever offered for 2000-3000 psi heavy duty service. Bores up through 12", strokes up to 22 feet, 19 standard mounting styles. Millions of maintenance-free strokes per cylinder *proven*. Available in single and double rod end, cushioned and non-cushioned, over-size rod, and "high temperature" service cylinders.

Over 2,000 selections — covering 17 popular mounting styles in 1½" through 5" bores and 1" through 36" strokes—now available for **immediate shipment.** Miller Air Cylinders also in stock for immediate shipment.

Write For Catalog and Stock List

WRITE FOR CYLINDER BULLETINS H-104 and A-105

Complete Miller cylinder line includes: air cylinders, 1½" to 20" bores, 200 PSI operation; low pressure hydraulic cylinders, 1½" to 6" bores for 500 PSI operation, 8" to 14" bores for 250 PSI; high pressure hydraulic cylinders, 1½" to 12" bores, 2000-3000 PSI operation. All mounting styles available.

MET J. I. C. HYDRAULIC STANDARDS years before their adoption in 1949.

SPACE-SAVING SQUARE DESIGN originated by Miller in 1945.

SALES AND SERVICE FROM COAST TO COAST

CLEVELAND • YOUNGSTOWN • DAYTON • PITTSBURGH • PHILADELPHIA • BOSTON • HARTFORD • NEW YORK CITY • BUFFALO • ST. PAUL • GRAND RAPIDS • DETROIT • FLINT • FORT WAYNE • SOUTH BEND • INDIANAPOLIS • MILWAUKEE • LOUISVILLE • KANSAS CITY • SEATTLE • LOS ANGELES • SAN FRANCISCO • BALTIMORE • DENVER • ST. LOUIS • MOLINE • CHICAGO • HOUSTON • TORONTO, CANADA and OTHER AREAS

Miller

MILLER FLUID POWER CO.
(Formerly MILLER MOTOR COMPANY)

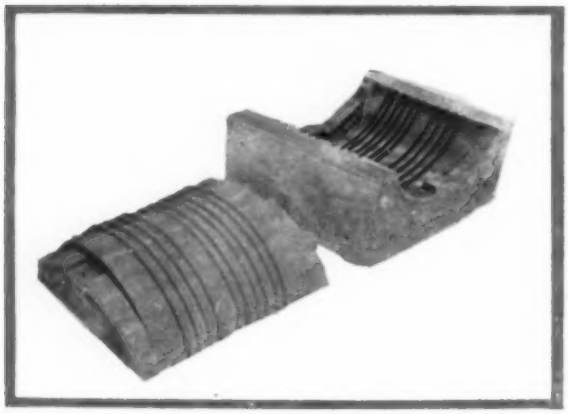
2010 N. Hawthorne Ave., Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

PLASTIC TOOLING

with

EPOCAST 4D



Simplifies Your Inventory!

Epocast 4D is a versatile, aluminum colored epoxy resin that can be used for a number of different tooling operations. The plastic material lends itself to laminating or casting and is equally suited for rigid cast faces or resilient cast faces by the addition of varying amount of "Flexibilizer T". Structural laminates for tooling fixtures are easily fabricated with the well wetting resin. Furane Tool Engineers have also originated a special technique for building plastic faced dies that will enable your die department to improve their production over existing methods. Write today for more information pertaining to Epocast 4D and the special die construction. No obligation, of course.

REFER TO TOOLING BROCHURE EP-54-9b

TYPICAL USES

- Draw dies
- Stretch dies
- Hydraw dies
- Form blocks
- Checking fixtures
- Drop Hammer Dies

furane plastics

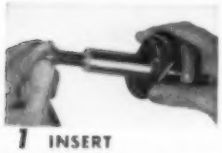
incorporated

4516 Brazil St. • Los Angeles 39, California

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-7-252-1

SAVE DRILLS!

NOW PRECISION DRILL GRINDING BY ANY INEXPERIENCED WORKER!



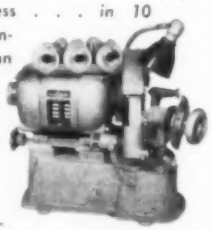
1 INSERT

2 PUSH

3 TWIST

4 GRIND

The BLACK DIAMOND Drill Grinder restores a worn drill to like-new precision sharpness . . . *in 10 seconds!* Any inexperienced man (or woman!) is an expert grinder with this unit. Both lips ground at once . . . web-thinning equally simple! Pays for itself many times over!



FREE BULLETIN

Get all the facts! 4 page illustrated bulletin gives complete story. *Write Today!*

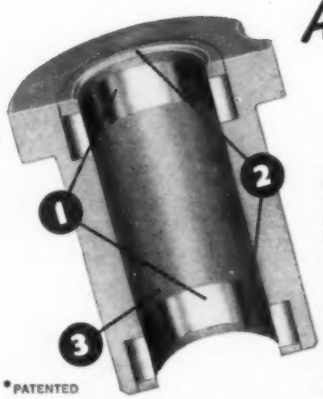
BLACK DIAMOND

SAW & MACHINE WORKS

NORTH AVE. NATICK, MASS.

USE READER SERVICE CARD; INDICATE A-7-252-2

MORE HOLES— MORE ACCURACY— FASTER— AT LESS COST



MEYCO

Carbide Inserted Bushings Are Doing It Daily!

HOW? Like this: (1) Last longer . . . with a life—in most cases—as long as solid carbide bushings at prices that come close to the prices of ordinary steel bushings; (2) Increased life for your drill jigs and fixtures; (3) Increased life for your drills and reamers; (4) Accuracy maintained for a LONG PERIOD of time; (5) Less non-productive machine time, less lost man-hours, because bushings need not be changed as often; (6) Inspection time saved, because of greater accuracy for a longer time; and (7) Less waste due to spoilage, for the same reason. Don't pass up a good bet! Get the dope on MEYCO Carbide Inserted Drill Jig Bushings today!

*PATENTED

1. Tungsten carbide rings at the points of wear; **2.** Steel rings protect drills and carbide; **3.** Special hardened alloy steel body.

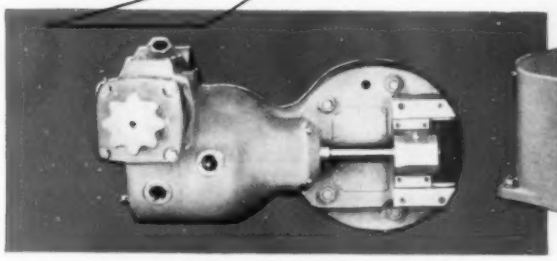
For information and prices write for Meyco Bushing Catalog No. 42

W. F. MEYERS CO., INC., BEDFORD, INDIANA

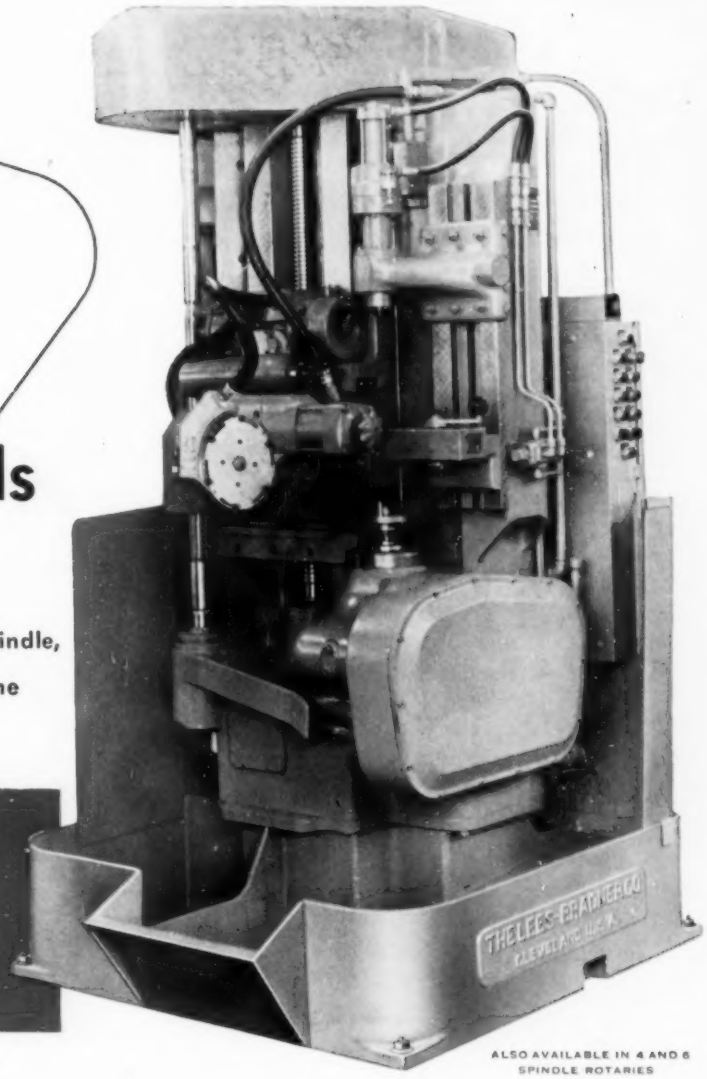
USE READER SERVICE CARD; INDICATE A-7-252-3

Hob today at tomorrow's speeds

with the new Lees-Bradner
Model 7, Type HD Single Spindle,
High Speed Hobbing Machine



Close-up shows new, heavier hob head with Timken bearing construction, 3-inch hob shift and new outer support.



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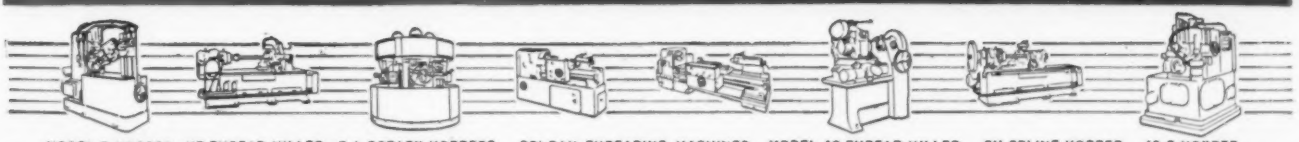

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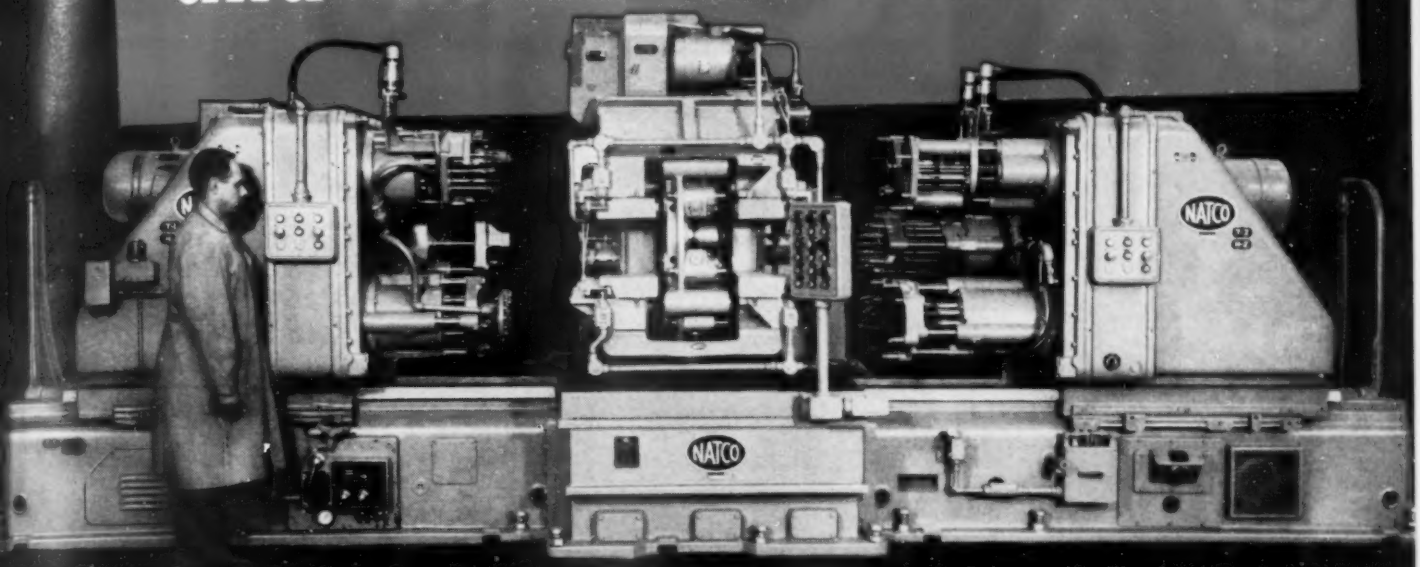

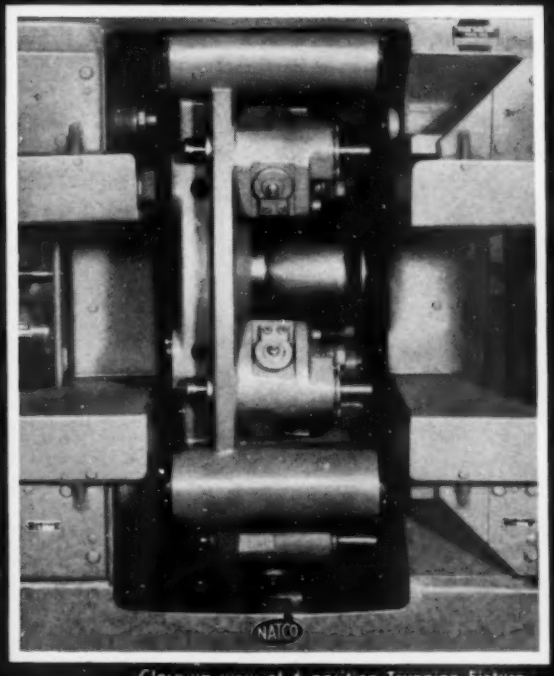

Close-up view of 6 position Trunnion Fixture

109 REFRIGERATOR COMPRESSOR SHELLS PER HOUR

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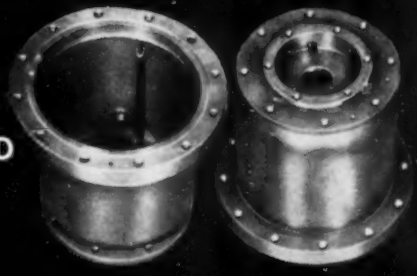

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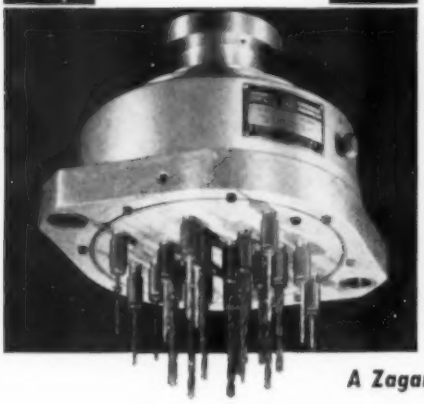

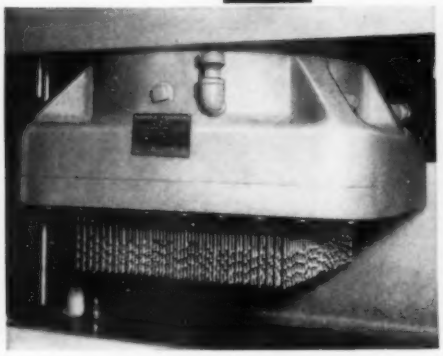

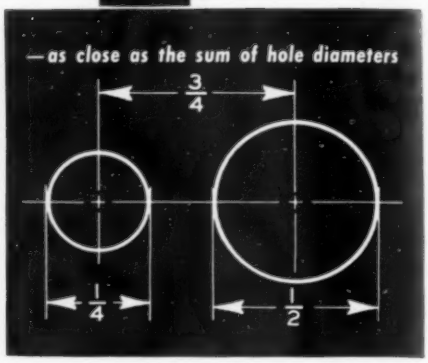

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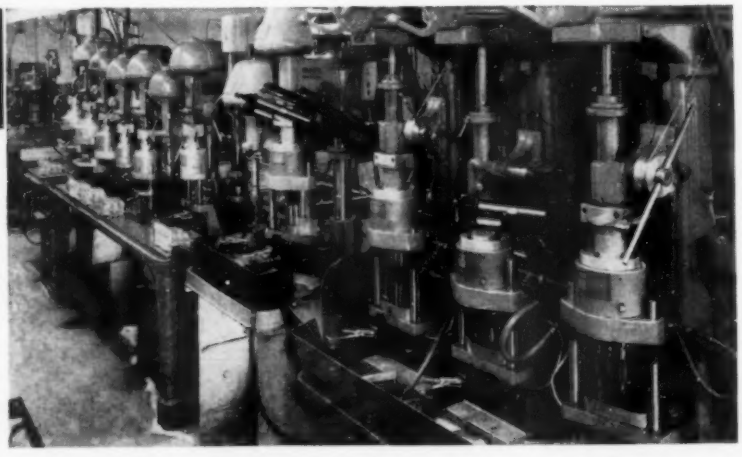
Whether your runs are long or short, let Zagar engineering survey your needs with a view to saving you the cost of special machines. In the case at the right two lines of *standardized* self-clamping drill jigs ream, tap and drill an aluminum die casting, both valve body and cover. The problem of limited production was readily solved. What, sir, are your requirements?



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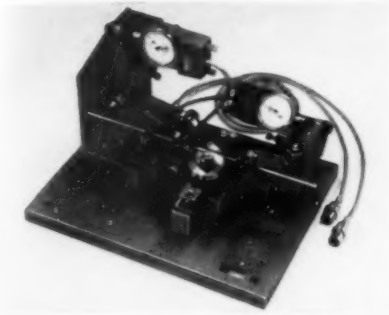
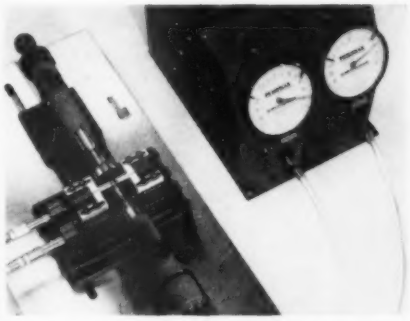


Gage continuously checks width and thickness of square wire travelling seventy feet a minute.

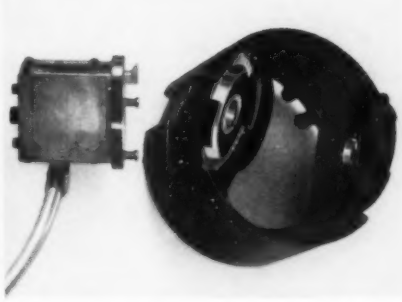
In-Process Gage measures twenty separate dimensions on thirteen different sizes of fabricated stator blades. Discards off-sizes.

Automatic Sorting Gage sorts valve stems for length, diameter, head thickness, hardness, out-of-round, and taper — at 2400 per hour.

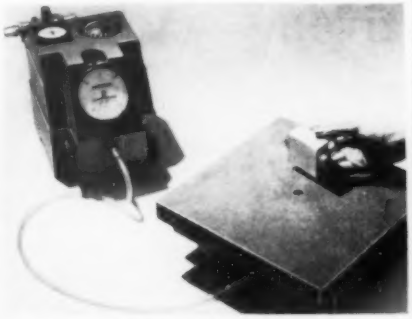
Air Gages



The amount of taper on a small shaft is determined by two 5,000 to 1 Dimensionairs with AirProbes. Measurements are in increments of .000020".

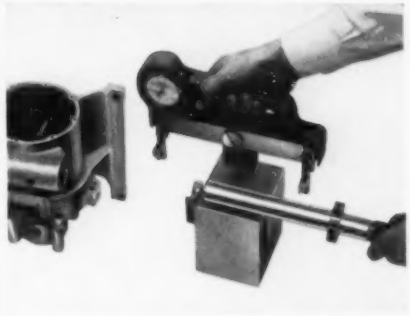


Dimensionair Gage measures a very shallow inside diameter. Frictionless motion-transfer unit contacts AirProbe which takes actual measurement.

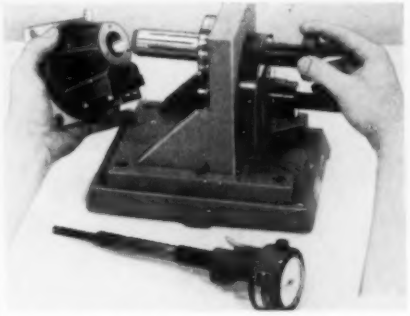


Air-Flatness Gage. AirProbe projects from black granite surface plate. Accurate to .000050" in any 2 x 2 ft. area.

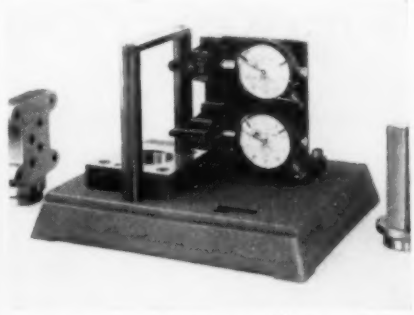
Mechanical Gages



Indicator Gage checks squareness of horizontal bores in relation to vertical bores. Gage shown is being applied to master.



Parallelism of the two lower holes with the large hole, and with each other, is checked on this specially designed fixture.



Dual-purpose Indicating Gage shows (1) squareness of face with flange and (2) distance from centerline to edge of face. Barrier protects contacts.

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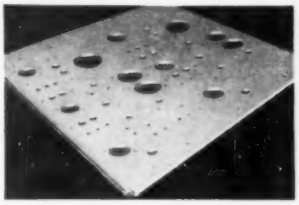
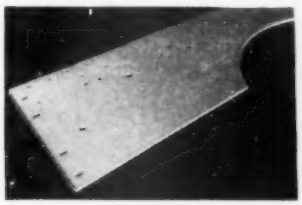
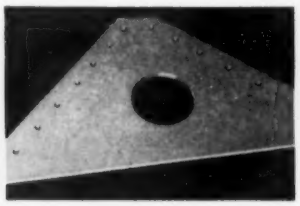


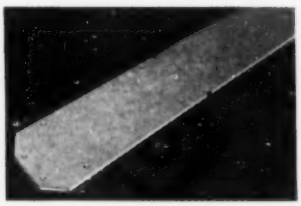
ELECTRONIC CHASSIS 12-1/2" x 11-1/2", with 118 holes and 4 notches was completed including setup in only 32.45 minutes and subsequent pieces in
6.44 minutes.



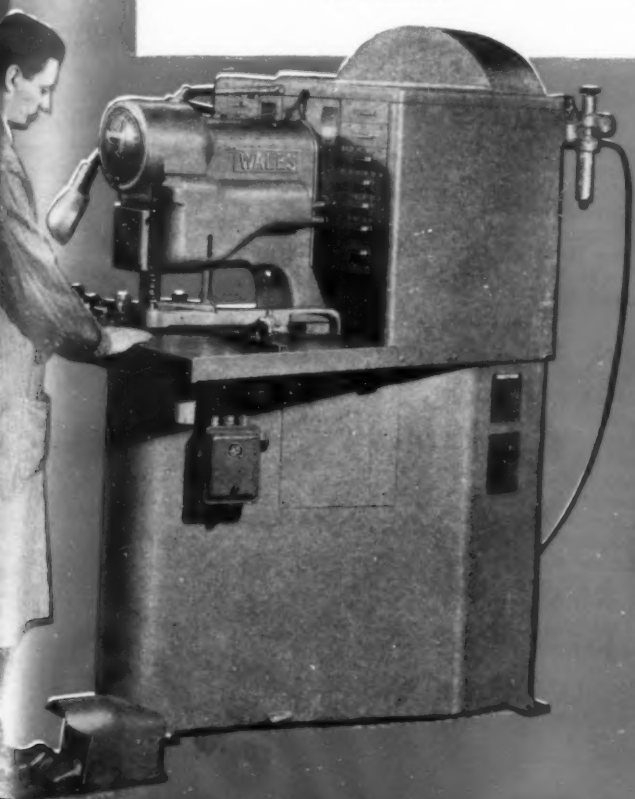
A part of FARM EQUIPMENT, 72-1/2" x 22" with 32 holes and nibbled cut out was finished including setup in only 12.01 minutes, subsequent pieces in
2.32 minutes.



AN AIRCRAFT part 7-1/2" x 4-1/2" with 15 holes and 1 notch was produced including setup in only 3.52 minutes and subsequent pieces in only
54 seconds.



Part of an ELECTRIC REFRIGERATOR, 39-7/8" x 8-1/2" with 10 holes and 4 notches was fabricated including setup in only 5.61 minutes and subsequent pieces in only
37 seconds.



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July 1955 Issue

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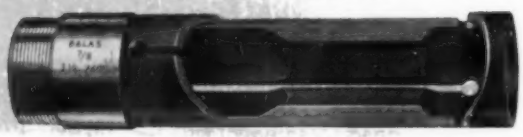

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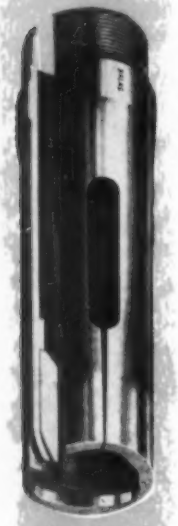

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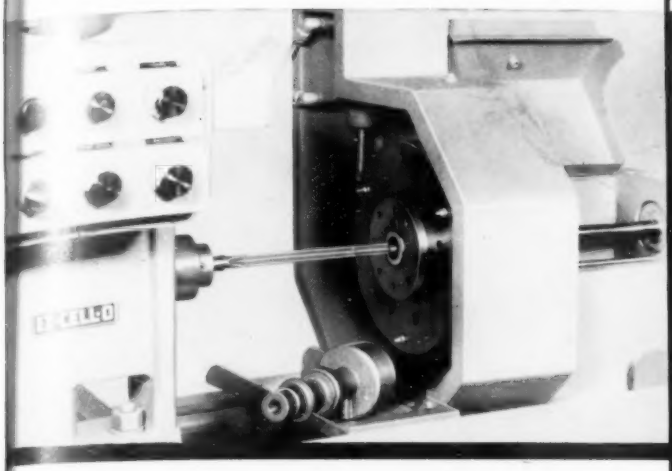

Photo with guards removed shows drill about to enter the guide bushing in the center of the chuck. Coolant oil under high pressure is directed through the spindle and drill, washing chips out of the single flute.

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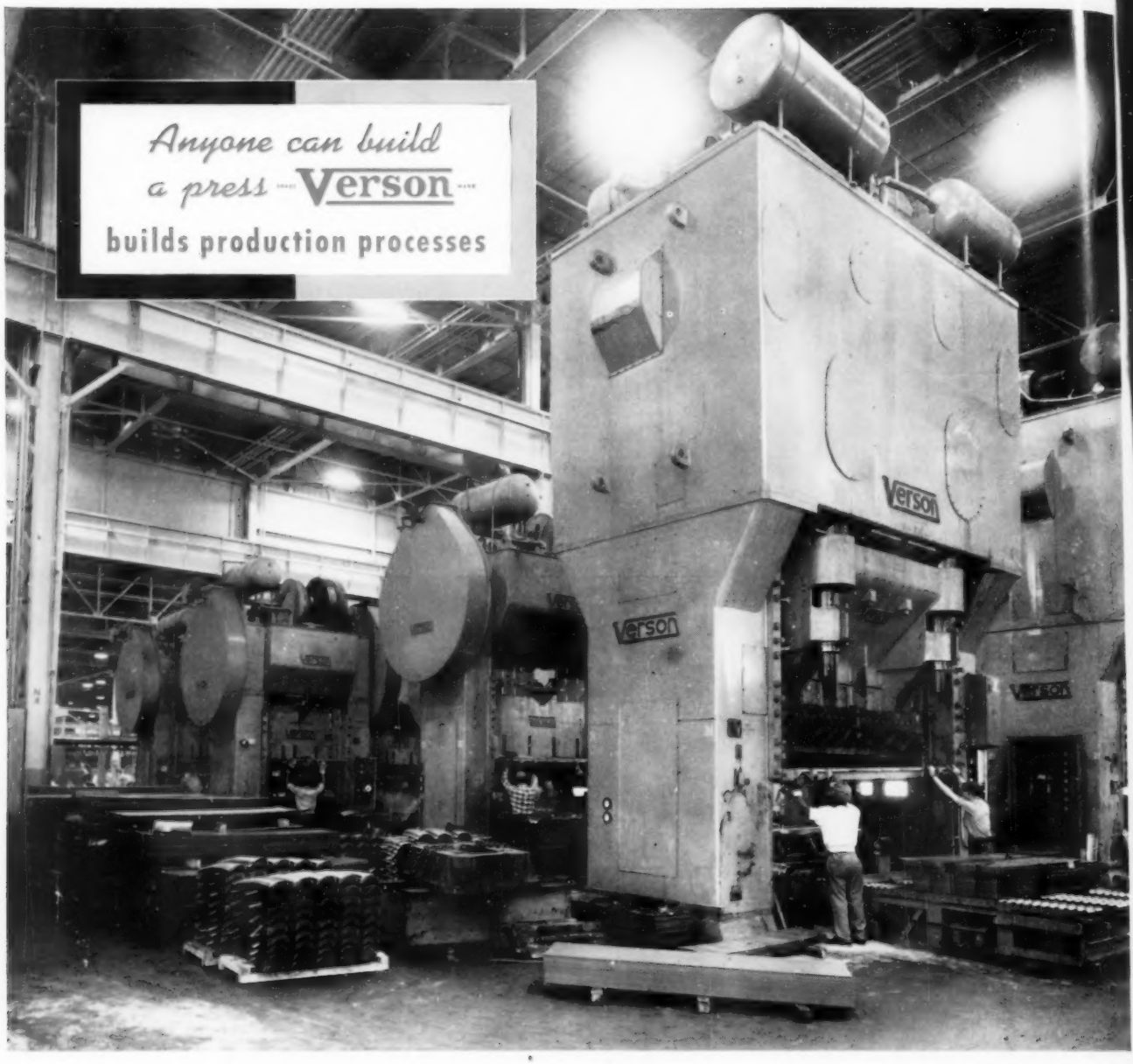

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